

**Report of COPLINK Detect™ User Study**  
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**I. Introduction**

Law enforcement, a time-critical and information-intensive endeavour, is greatly facilitated by implementation of information technology systems that can sift through mountains of data and significantly reduce the time to retrieval of relevant investigative leads pertinent to a case at hand. COPLINK Detect™ v.1.0, funded by the National Institute of Justice and the National Science Foundation, was developed by a team of researchers, domain experts, and contracted developers at the University of Arizona Artificial Intelligence Laboratory, the Tucson Police Department, and Knowledge Computing Corporation. COPLINK Detect incorporates advanced technologies for uncovering relationships between information types to reveal real avenues to resolution of cases. The present report discusses findings of a recent user study conducted for the purposes of field testing and tracking technology adoption.

**II. Research Questions**

We were interested in learning how the subjects were using the software tool, the types of queries they were performing, successes they had had in solving cases, and their general impressions regarding ease of use and improved search effectiveness as compared to the existing legacy records management system. Data collection was designed to provide both a qualitative and a quantitative assessment of the use of the system over a seven week period.

**III. Research Design and Methodology**

An initial field test / stress test of COPLINK Detect 1.0 beta version was conducted with 10 detectives and crime analysts at Tucson Police Department. During that phase, a few minor interface and system bugs revealed and corrected. When it was clear that the system was robust enough for a larger field test, a user study was designed to further uncover unknown system and interface bugs, to allow for a real-time performance test for system failure, and to assess the usefulness and adoption of the Detect application. The study was run over seven weeks (1 June 2000 – 25 July 2000.)

*Participants and User Orientation*

COPLINK Detect v1.0 was deployed to 33 self-selected user study participants, including 7 crime analysts, 17 detectives, 4 officers, and 3 sergeants representing 16 different department units. Initially, 25 users signed up as participants and were trained in the use of the application at a user orientation session. Over the course of the study, 8 additional users learned that they system was available and either requested system access and training or downloaded, installed, and learned to use it own their own.

A ninety-minute orientation session was held to brief participants on the background of the project, the intention and scope of the study, the instructions for accessing and installing the software application on their networked laptop computers, and the channels for communication with the study coordinators. Following discussion of logistics, a detective and study coordinator at the agency demonstrated the system's functions and features by performing a real-time search for an actual case he was investigating at the time.

### *Data Collection & Measures*

Data relevant to the research questions was collected by three methods: verbal reports, “search notes” for searches they performed, and electronic transaction logs.

Verbal reports from the subjects were collected over the course of the study, 4 study coordinators made rounds through the department once or twice per week to visit with participants and engage them in conversation regarding what was working, what wasn’t working, any questions or confusion they had regarding system features and functionalities. Over the seven week period, each participant was visited at least three times.

“Search Note” forms were distributed to the participants at the orientation sessions to assist them in recollecting how they conducted their searches. During the visits, we gathered any “search notes” that been filled out, and used these as a basis for conducting the interviews. The “search notes” forms included the following questions:

- Type of Case
- What is your desired goal or type of information you are looking for?
- Was your goal reached?
- Please assess the usefulness or relevance of the information that was returned.
- How easy was the system to use? Please describe any difficulties you had.
- Please describe how COPLINK Detect affected your productivity for this search.
- Please compare this search experience using COPLINK Detect with your normal means of searching/investigating.
- Please compare the amount of time it took you to complete this particular search using COPLINK Detect to a similar search in RMS or other databases you typically use.

The log data was derived from Tucson Police Department’s Oracle Application Server’s transaction log file. Every search or query conducted in COPLINK Detect creates a transaction in the Oracle Application Server, which stores information specific to each transaction in a transaction log file. Information present in each logged transaction includes information such as: the type of search or query that was conducted, a unique identifier for each user, the date and time of the transaction, and the date and time that each user logged onto the system. This data is then organized into four separate tables using PL/SQL procedures. This data is further analyzed with SQL queries and the resulting data is imported into Microsoft Excel spreadsheets. The log file was also used to corroborate verbal reports with quantitative data.

## **IV. Results**

The following definitions apply. A “new session” is initiated when a user: a) logs in anew, or b) selects the “New Session” button on the COPLINK Detect Interface. A “query” is initiated when a user enters query criteria into the search panel on the left side of the interface, and clicks on the “FIND” button. The result of a query is the display of a Person, Location, Vehicle, or Incident Summary Screen. An “entity addition” occurs when a user selects an item from a Person, Location, Vehicle, Incident, or Relationship Summary Screen.

### *Pattern and Frequency of Use*

Figure 1 shows that users performed 73% of sessions on Tuesdays, Wednesdays, and Thursdays. This is consistent with the fact that all detectives are scheduled to work on those three days, with

remaining workdays being split so that half of detectives work at the beginning of the week and half at the end of the week. At least 4 participants reported having taken a summer vacation during the study.

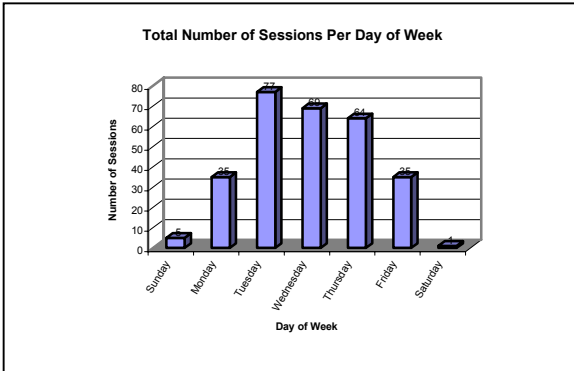


Figure 1: Total Number of Sessions Per Day

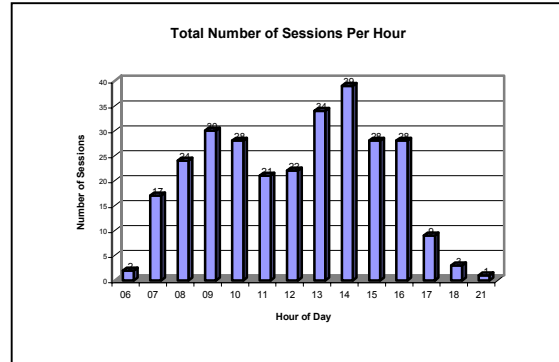


Figure 2: Total Number of Sessions Per Hour

COPLINK Detect sessions were fairly evenly spread throughout the day, with 40% of sessions being initiated before 12 pm, and 60% of sessions being performed after 12pm (See Figure 2). Sessions initiated each week were relatively consistent throughout the period of study, with an average of about 40 per week for the entire user group.

Figure 3 details the relative amount of sessions conducted by each job classification. Crime analysts initiated the most sessions, 53 over the seven week period, followed by robbery with 40 sessions, patrol with 30 sessions, homicide and gangs with 27 sessions each, and adult sexual assault with 26 sessions.

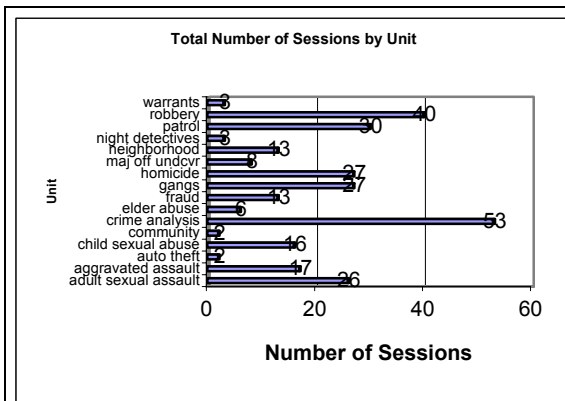


Figure 3: Total Number of Sessions by Unit

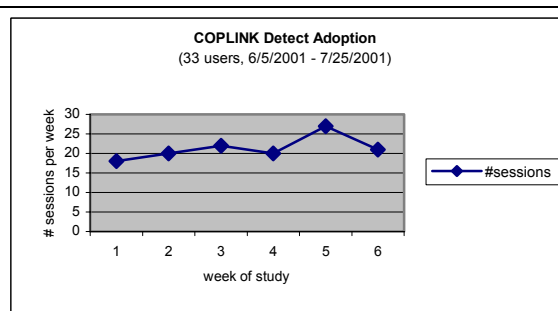


Figure 4: COPLINK Detect Adoption

While this may appear to be active use of the system, a relatively limited number of the study participants were fully engaged in the study and committed to regular use and system testing. During the study period, a group of 33 study participants averaged 21 active sessions per week. When the pattern and frequency of participants' searches were studied in detail, the following was observed.

During the 7 weeks for the 33 users:

- 66% of sessions were performed by the 9 most active users (29% of users) (>12 sessions),
- 51% of sessions were performed by the 6 most active users (19% of users) (>17 sessions)
- 37% of sessions were performed by the 4 most active users (13% of users) (>23 sessions)
- 10% of sessions were performed by the single most active user (3% of users) (>30 sessions)

Stated another way, of the 33 users:

- 35% of users initiated a new session at least 13 times in 7 weeks (>1 time per week)
- 19% of users initiated a new session at least 18 times in 7 weeks (2-3 times per week)
- 13% of users initiated a new session at least 24 times in 7 weeks (>3 times per week)
- 3% of users initiated a new session at least 30 times in 7 weeks (>4 times per week)

By contrast, prior to the study, 70% of users reported using RMS more than 5 times per day. In any institution, this pattern of technology adoption through the sharing of success stories can be expected. As an overall usage trend, Figure 4 shows that the adoption rate in this study was slow enough to indicate a need for agencies to undertake a rigorous support and training effort to accompany software installation and distribution.

We have found that when a user in a unit at TPD has used COPLINK Detect in an investigation, and successfully identified a useful lead or even an apprehension, the user shares his/her success with others in the unit. This motivates others in the unit to give the system a try. For example, a case was solved in one of the detective units using COPLINK Detect (see success stories section below), and as a result, others in the unit requested assistance with downloading the system and instruction in its use.

### *Manner of Use*

Generating COPLINK Detect associations is a three-step process. The user first conducts queries in the COPLINK Connect database to find specific entities (persons, locations, vehicles, or incidents.) The user selects entities from the query result sets and "adds" them to the COPLINK Detect Association Window. When the Association window contains all the known or suspected entities of interest, the user clicks the "Find Relationships" button. The associated entities are then displayed in a "Relationship Summary" table. Data from the system transaction logs were analyzed to understand how the study participants were using the system.

### Queries

Figure 5 shows the number of COPLINK Connect searches that were conducted in COPLINK Detect. Over the seven-week period, the users performed 965 queries (using the COPLINK Connect search panel on the left side of the screen). Of these, 763 (79%) were queries for known or suspected Persons, 94 (10%) were for known or suspected Locations, 78 (8%) were for known or suspected Vehicles, and 30 (3%) were for known or suspected Incidents. All 31 users performed Person queries, while 15 (50%) searched for Locations and 12 (38%) searched for Vehicles. The least frequently used query mode was Incident search, utilized by just 5 users (16%).

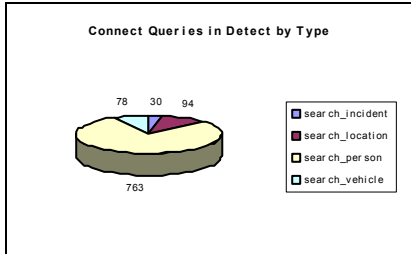


Figure 5: Connect Queries in Detect by Type

COPLINK Detect 1.0 does not impose a time restriction on sessions, i.e., sessions are not terminated when a system imposed session duration has been surpassed. Therefore, it is difficult to determine how many queries are performed in a distinct session, since a user can leave the system active for days without logging in anew and without selecting the “New Session” option. For all users, the overall average number of queries per session was 3.4, and 70% of users (22) performed, by average, fewer than 4 queries per session. No significant differences in manner of system use based on “job class” or department/unit was identified.

#### “Find Relationship” Searches or Detect Searches

During the Study Period, users performed 584 Detect Searches.

#### Entity Additions

We are analyzing the data to determine whether it is possible to discern how many entities that were added from a Person, Location, Vehicle, or Incident Summary Screen versus how many were added from a Relationship Summary Screen. If this information is available, it will allow us to determine the proportion of entity additions that were made possible because new and possibly unknown information was presented to the user by the Detect Searches.

***ROSIE & HOMA: This work regarding the patterns of entity additions was not done at the company as a part of the user study. – Hsinchun suggested that if it is of interest to the potential readers of an academic paper, the analysis should be done at the Lab.***

#### Flags

As Figure 6 illustrates, the COPLINK Detect Interface allows users to deselect entity types in which they are not interested. This shortens the query time and refines the Detect search from the outset. The Person flag was deselected in 7% of Detect Searches, the Vehicle flag in 11% of searches, the Incident flag in 16%, and the Location flag in 18%. This indicates that users are most interested in Person associations. In version 1.0 of COPLINK Detect, home addresses are not available. It will be interesting to see how whether the rate of deselection for the Location flag is reduced when users have access to home addresses in version 2.0.

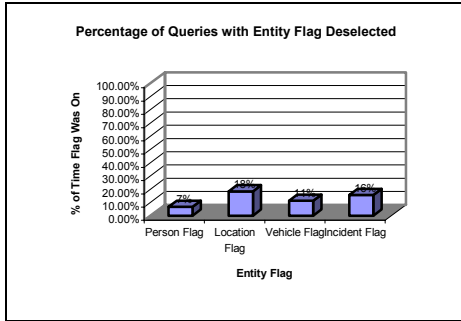


Figure 6: Percentage of Queries with Entity Flag Deselected

### Limiting by Crime Type

In 122 of the 584 Detect searches (21%), users chose to limit the scope of their search by UCR Crime Class (Crime Type).

### *System Performance*

493 of the 584 Detect Searches (84%) were completed in less than 3 seconds. Of those, 359 (61%) required less than 1 second. The longest query required 36 minutes (Figure 7.) These values represent only the time required for the server to retrieve the results, and does not include the time required for the GUI to display the information. The time required for the GUI to display the retrieved data is variable and dependent on the specification of the machine on which the application is running.

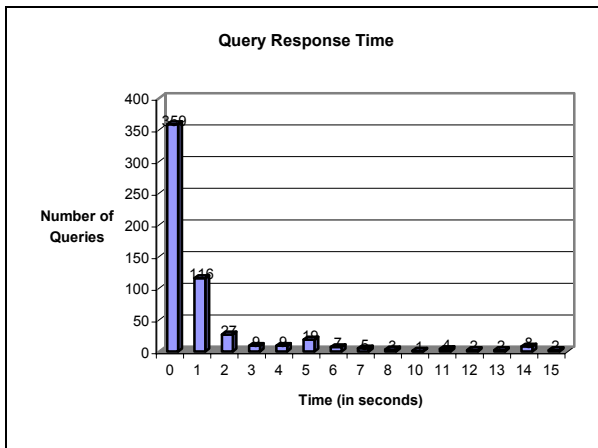


Figure 7: Query Response Time

### *User's Comments and Qualitative Assessment*

Most users found the system relatively easy to use. This is not born out by any hard data, as the compliance with the use of the "Search Notes" journal sheets was extremely low despite regular encouragement by the study coordinators. The interviews, however, revealed a broad range of understanding of and facility with using the software. Some users who attended the orientation and demonstration session were still having difficulty with interpreting the

interface and the display of data. By contrast, some users who had not attended the demonstration were able to find the application on the shared drive on their own, install it unassisted, begin using it without instruction, and retrieve associates that led to successful resolution of a case.

Some user comments regarding **ease of use**:

- “It’s easier every time I use it. The system is still a little slow, but much better since the update.”
- “Very useful. Very easy. Very user friendly.”
- “Very easy.”
- “Both useful and relevant. All the info was on one screen – the location, the incident, and the person names for easy access.”
- “The system was easy to access and use.”
- “It was easy to use once I figured out how to run the relationship part. Didn’t take long to get used to.”
- “The information is relevant, and the queries are very easy. The information is easy to understand.”

Some user comments regarding **effectiveness of search** (as compared to RMS):

- “Search was much shorter than the standard way of retrieving the information. There is a much shorter time requirement with Detect and you do not have to remember all the different commands to do it.”
- “If I tried this with RMS, I would have had to go into each separate event and I look at associates.”
- “It took less than one minute to find all the associates and incidents associated with the suspect.”
- “It took just a few seconds (compared with what could have been minutes in [existing system]) to find all the information that was needed.”
- “You get more information utilizing less effort. Even though [the existing system] has a follow-the-links key now, COPLINK is still a much quicker way to look for associates.”
- “Much quicker. It would be nice to be able to connect to other agencies.”
- “To have run all the [car model] and [car model] from the 60s and 70s would have taken days.”

## V. Conclusions

COPLINK Detect v. 1.0 was subjected to a field test and user evaluation study. The system was not widely adopted by the participants of the study. Verbal reports from users who did not readily adopt the software indicated that the current version does not support the type of searching they need to perform, and that in spite of the potential added benefits offered in the Detect product, it is still easier for them to use RMS than to learn a new tool for a limited proportion of the searches they must perform. Those who saw the potential for identifying associates and relationships between data (persons, locations, incidents, and vehicles) but did not want to switch back and forth between the two systems did, however, indicate an interest in

participating in an evaluation of version 2.0, which will offer many of the sorts of searches not currently possible in version 1.0.

Those study participants who actively made use of COPLINK Detect v. 1.0 offered a very positive assessment of the system and its potential for facilitating and hastening the investigative process.