Technical Report 1417

Assessment and Feedback Applications of Rich Picture Methodology

Jayne L. Allen
Randy J. Brou
U.S. Army Research Institute

Sterling Wiggins
Samantha Dubrow
Krista Ratwani
Aptima, Inc.

Michael Lerario
Crispian Consulting, Inc.

November 2022

United States Army Research Institute for the Behavioral and Social Sciences

U.S. Army Research Institute
for the Behavioral and Social Sciences

Department of the Army
Deputy Chief of Staff, G1

Authorized and approved:

MICHELLE L. ZBYLUT, Ph.D.
Director

Research accomplished under contract
for the Department of the Army by

Aptima, Inc.

Technical reviews by

Ashley H. Wittig, U.S. Army Research Institute
Brendon Woody, U.S. Army Research Institute

DISPOSITION

This Research Report has been submitted to the
Defense Information Technical Center (DTIC).

REPORT DOCUMENTATION PAGE

Form Approved
OMB No.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
November 2022	Final	June 2019 – November 2020

4. TITLE AND SUBTITLE
Assessment and Feedback Applications of Rich Picture Methodology

5a. CONTRACT NUMBER
W911NF19F0033

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
622785

6. AUTHOR(S)
Allen, Jayne L., Brou, Randy J., Wiggins, Sterling, Dubrow, Samantha, Ratwani, Krista, & Lerario, Michael

5d. PROJECT NUMBER
A790

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Aptima, Inc.
12 Gill St. Suite 1400
Waltham, MA 01801

8. PERFORMING ORGANIZATION REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U. S. Army Research Institute
for the Behavioral & Social Sciences
6000 6TH Street (Bldg. 1464 / Mail Stop 5610)
Fort Belvoir, VA 22060-5610

10. SPONSOR/MONITOR'S ACRONYM(S)
ARI

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
Technical Report 1417

12. DISTRIBUTION/AVAILABILITY STATEMENT:
Distribution Statement A: Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES ARI Research POC: Jayne L. Allen, Ph.D., Fort Benning Research Unit

14. ABSTRACT (200 words max)
Expertly navigating ambiguous situations requires an understanding of both the explicit and implicit variables that are present. While traditional knowledge elicitation methods are successful in capturing the details that experts can articulate, the Army would benefit from novel methodology aimed at capturing the tacit details that experts note without conscious awareness. Rich Picture Methodology (RPM) is a potential approach that the Army could use to elicit deeper information about the way Soldiers think about and solve complex ill-structured problems. Using RPM, an individual (or group) draws a picture representing the myriad personal, social, and organizational factors that influence a situation. The drawing is followed by a discussion about the picture, usually led by a researcher. This paper presents two exploratory studies of RPM conducted in Army training courses. The findings indicate that RPM can be used to unpack elements of the Army's Leadership Requirements Model (LRM), including differences in expertise. Suggestions for using RPM in the Army contexts of assessment and development are offered. Importantly, given the dearth of specific information for using RPM in the literature, this report contains the actual prompts and scripts that were used.

15. SUBJECT TERMS
Knowledge elicitation, Rich pictures, Tacit knowledge, Implicit knowledge, Army's Leadership Requirements Model (LRM), Expert/novice, Assessments, Feedback, Development, Attributes, Competencies

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
					Dr. Jennifer Tucker
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER
Unclassified	Unclassified	Unclassified	Unlimited Unclassified	35	706-366-7312

Technical Report 1417

Assessment and Feedback Applications of Rich Picture Methodology

Jayne L. Allen
Randy J. Brou
U.S. Army Research Institute

Sterling Wiggins
Samantha Dubrow
Krista Ratwani
Aptima, Inc.

Michael Lerario
Crispian Consulting, Inc.

Jennifer S. Tucker, Chief
Ft. Benning Research Unit

November 2022

ACKNOWLEDGMENTS

We would like to thank the Soldiers at Fort Polk, LA, and Fort Benning, GA who participated in the research and provided valuable feedback on the use of rich picture methodology.

ASSESSMENT AND FEEDBACK APPLICATIONS OF RICH PICTURE METHODOLOGY

EXECUTIVE SUMMARY

Research Requirement:

The Army seeks to assess and develop Soldiers throughout their careers. This requires a clear understanding of what the Soldier knows—both to ensure fidelity in the assessment and to provide actionable feedback. It also requires that the differences between expert and novice sensemaking and performance are clearly articulated. While explicit knowledge (e.g., knowledge contained in textbooks) is readily accessible and amenable to traditional knowledge elicitation methods, implicit knowledge (e.g., the recognition of patterns and connections that have become automatic for experts) is harder to both communicate and assess (Crandall et al., 2006). Rich picture methodology (RPM) is a potential approach that may allow implicit knowledge to be captured and shared, important because such knowledge often distinguishes between expert and novice understanding (Crandall et al., 2006; Klein, 1997; Klein & Hoffman, 1992; LaFrance, 1989). The main goal of this research was to begin exploring the utility of RPM to the Army, focusing initially on capturing differences in Soldiers' development of leadership competencies as described in the Army's Leadership Requirements Model (LRM: Department of the Army, 2019).

Procedure:

Two exploratory studies were conducted in different Army training courses; each study included four participants. Targeting the *Intellect* and *Leads* components of the LRM, the prompt for the first study was "Recall the most challenging problem you've had to solve in your Army career." Participants were given 25 minutes to draw their pictures and then researchers interviewed them about the picture they had produced. Drawings were evaluated according to several criteria, including the demonstration of the competencies of interest. The second study examined the *Leads* dimension more deeply by focusing on one of its subcomponents, *Builds Trust*. Participants were given 25 minutes to respond to the prompt, "Recall a time when you experienced a barrier to building trust with someone, the actions you took, and the result of your actions." Researchers again interviewed participants about their drawings, and drawings were evaluated using the same criteria as in the first study.

Findings:

Results from both studies indicated that utilizing RPM within the Army could enhance current assessment and development techniques by capturing tacit knowledge and encouraging reflection. Study 1 pictures included indicators of the *Leads* and *Intellect* dimensions of the LRM while Study 2 pictures included indicators of the *Builds Trust* subcomponent, suggesting that any component of the LRM can be targeted by tailoring the prompt that is used. Anecdotal evidence of differences in expertise across rich pictures was identified. For example, novices seemed to think about the problem very literally, drawing the "facts" of the event as it occurred using a timeline. Experts, on the other hand, focus much less on the specific events that occurred and instead draw and talk about the different stakeholders they were considering and why the

different elements of the picture were important for the situation. Linking the application of RPM to the LRM and an accompanying performance rubric (the behaviorally anchored ratings scale for LRM; Toumbeva et al., 2018) in Study 2 was useful in determining the drawer's level of competency development. We present suggestions for conducting RPM, interpreting rich pictures, and future directions of study.

Utilization and Dissemination of Findings:

As a tool for both assessment and development, RPM may be integrated into existing Army processes. This paper's descriptions of lessons learned in applying RPM and its inclusion of specific prompts that were used can advance the use of the methodology not only in the Army, but in the field of knowledge elicitation more generally. Comparisons between student and instructor drawings may help the student develop insight into assumptions and relations that underlie a given problem space. Moreover, the use of RPM in conjunction with an accompanying performance rubric offers a unique approach to making comparisons across rich pictures that indicate developmental differences in the drawers themselves.

ASSESSMENT AND FEEDBACK APPLICATIONS OF RICH PICTURE METHODOLOGY

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Assessment and Feedback Applications of Rich Picture Methodology

Introduction

The Army seeks to assess and develop Soldiers throughout their careers. This requires a clear understanding of what the Soldier knows—both to ensure fidelity in the assessment and to provide actionable feedback. It also requires that the differences between expert and novice sensemaking and performance are clearly articulated. While explicit knowledge (e.g., knowledge contained in textbooks) is readily accessible and amenable to traditional knowledge elicitation methods, implicit knowledge (e.g., the recognition of patterns and connections that have become automatic for experts) is harder to both communicate and assess. Rich picture methodology (RPM) is a potential approach that may allow implicit knowledge to be captured and shared, important because such knowledge often distinguishes between expert and novice understanding (Crandall et al., 2006; Klein, 1997; Klein & Hoffman, 1992; LaFrance, 1989).

RPM uses pictorial representations to capture an individual's perspective about a situation and its important features (e.g., objects, people, events, procedure, concepts, feelings, and organizational/social/personal factors that influence the situation; Armson, 2011). Rich pictures use symbols (e.g., stick figures, basic shapes, arrows, thought bubbles without sentences) to document relevant features, including the relation of these features to one another. Traditional knowledge elicitation methods such as interviews and questionnaires can lead Soldiers to think about problems in a linear fashion, causing them to focus on their conscious and simplified perceptions of an event (Berg, 2013), rather than revealing more nuanced perceptions that contributed to the decisions that were made. In contrast, RPM can not only highlight important incident details but also preserve the context in which they occurred. Moreover, RPM can reveal key information and interactions that influenced the appraisal of the situation but that were unarticulated before the methodology was used.

The main goal of this research was to begin exploring the utility of RPM to the Army, focusing initially on capturing differences in Soldiers' development of leadership competencies as described in the Army's Leadership Requirements Model (LRM: Department of the Army, 2019). This paper begins with a literature review of RPM, including its theoretical foundation and instructions for implementation. It then describes two preliminary studies designed to capture developmental differences in the *Intellect* and *Leads* components of the LRM (Study 1) and the more granular *Builds Trust* subcomponent of the *Leads* dimension (Study 2). Specific findings from each study are discussed, including protocol changes from Study 1 to Study 2 intended to assist in identifying differences in expertise evidenced by the rich pictures. Following the analysis of the results from the two studies, the discussion section provides recommendations for how RPM may be used in the Army and guidelines for researchers interested in using RPM more generally.

Review of Rich Picture Methodology

RPM is a technique used to interview participants about their experiences or their responses to situations through drawings and diagrams (Bell et al., 2016: Bronte-Stewart, 1999;

Stowell & West, 1994). Participants are encouraged to use drawings to express their thoughts and to avoid using words when possible (Bell et al., 2016; Checkland, 1981). A rich picture generally includes the actors and tools related to an event, the relationships between the actors and tools, and the participant's thoughts and feelings about the event (Monk & Howard, 1998).

RPM is typically used to investigate unstructured problems for which individuals within a system or organization are likely to have different perspectives and perceptions (Gasson, 1994). RPM has been used to help individuals unpack complex and challenging situations by capturing and elucidating potentially hidden aspects of a situation (Guillemin, 2004) in a variety of domains, including systems engineering (Boardman & Sauser, 2008) and sustainable development (Bell et al., 2016). In healthcare, research used RPM to compare differences in expert and novice capabilities around defining problems and systems thinking (Cristancho et al., 2015; Cristancho et al., 2017). RPM has also been used in groups to assess explicit and implicit understandings of problem situations, shared mental models and team learning (Bell & Morse, 2013; Dennis, 2010).

RPM is beneficial because it helps participants to reflect on specific events while preserving the context. Because the participant, rather than the interviewer, structures the interview by producing the picture on which it is based, more of the context can be retained. The participants control the direction of the narrative, which can be especially important depending on the mission or task. For example, specific contextual elements greatly affect the outcome when determining the best route or reporting on enemy dispositions in a ground reconnaissance operation; these elements—including the relevant stakeholders and the connections between them—can be captured through RPM (Checkland, 2000). Additionally, because rich pictures are limited to a single sheet of paper or one tablet screen, they require participants to be both detailed and selective about what they draw, as they will not be able to include everything (Berg, 2013).

In addition to being heavily dependent on the context, rich pictures are uniquely personal. Participants are asked to include themselves in their drawings, which can lead them to focus on their specific role and how it interacts with other roles (Cristancho et al., 2015). By using drawings instead of words to represent their experience, participants may make connections that had been hindered by the linear processes of verbalizing and writing. Cristancho (2015) found that using RPM helped surgeons to explain thoughts and factors they had not previously considered consciously nor verbalized. Rich pictures also show individual perspectives, which may uncover different emotions, ideas, and concerns from multiple people regarding the same event, enabling a broader understanding of the situation (Avison & Fitzgerald, 2003). Additionally, the process of drawing a picture is more memorable than responding to a prompt verbally and, therefore, can help with memory and retention (Bronte-Stewart, 1999).

Foundations of RPM

RPM originated from a systems engineering approach that used visualizations to convey details about complex situations and events (Cristancho et al., 2015). As with rich pictures, systems engineering diagrams include contextual components of a situation as well as interdependencies and connections between components (Boardman & Sauser, 2008). Diagrams

in systems engineering have been used to explicate both "hard" and "soft" systems, where the former include the core components of a situation and the latter include the more complex and intricate relationships that are often social in nature (Young, 2005).

Whereas hard systems can be used to describe a prototypical process, soft systems methodology (SSM) allows for different perspectives and ideas that may not be concrete or common to all stakeholders to be integrated (Bell et al., 2016; Cristancho, 2014). SSM was first used to diagram challenging problem situations, allowing those creating the diagrams to reflect on the situation (Gasson, 1994), and those viewing the diagrams to compare such representations with their own perspectives. RPM can be thought of as a specific subset of SSM that focuses on using diagrams with strong visual and graphic representations of situations (Bell & Morse, 2013). Compared to general soft systems diagrams, rich pictures emphasize the complexities of perspectives, affect, and social relationships and can be used for self-reflection or communication (Bronte-Stewart, 1999; Monk & Howard, 1998). Bronte-Stewart (1999) argues that rich pictures are "the most memorable and reusable part of SSM" (p. 83).

Comparison of RPM to Traditional Knowledge Elicitation Methods

Many techniques are used to elicit knowledge, aid in self-reflection, and assess abilities. RPM is a novel technique that contributes to these efforts in ways that more traditional methods do not. Interviewing can be used to gather unique perspectives from individuals or teams about a topic or scenario (Berg, 2013; Weiss, 1994). However, interviews are impacted by the interaction between the interviewee and the interviewer. Even if structured interviews are used, interviewees may adjust their answers based on the perceived expertise of the interviewer. When interviewers are experts, interviewees may refrain from sharing information they believe the interviewer already knows (Cristancho, 2015). When interviewers are non-experts, interviewees often skip complex, yet critical, information they do not believe interviewers will be able to easily understand (Berg, 2013; Cristancho et al., 2015).

Questionnaires are also commonly used for knowledge elicitation and are less expensive and time-intensive than interviews, allowing for the gathering of information from a wide variety of participants. Unfortunately, open-ended questionnaires create challenges for synthesizing and interpreting responses, and misinterpretation of responses is a common problem (Berg, 2013). Fixed-response questionnaires, such as multiple-choice surveys, do not allow for the respondent's explanation of the complexities and interdependencies of a situation. Responses are constrained by the choices that the survey creator provides.

Contextual design and storyboarding are ethnographic methods that use combinations of interviews, diagrams, questionnaires, and observations (Berg, 2013). A key benefit of such methods is that they take place within a contextualized environment, allowing situationally relevant variables to be captured. Additionally, the triangulation of multiple methods helps to eliminate some of the disadvantages of each individual technique. Unfortunately, contextual design and storyboarding tend to be expensive and time-intensive, and participants often do not want to be observed or may act differently while being observed. Another limitation is that these

methods are typically used to explain what happened during an event, but do not include the various factors that may have caused the event to occur as it did.

The Army Design Methodology (ADM) uses multiple techniques to harness both critical and creative thinking to describe problems and their possible solutions. There are several components to ADM, two of which are visualizations and graphic modeling (Department of the Army, 2015). Visualizations in ADM include sketches of symbols and the relationships between those symbols used to tell a story about a particular event. As with rich pictures, it is common for verbal statements to support and explain visualizations (Young, 2005). Graphic modeling includes the range of visualization types that are used in ADM: mind-maps, causal loop diagrams, influence diagrams, and rich picture diagrams. ADM maps and diagrams show relationships between nodes (e.g., actors, symbols, tools) and often include information about critical decision points in a situation. Although similar to RPM, ADM is typically used for operational and strategic planning purposes, particularly in the absence of critical information. RPM, on the other hand, is less focused on what is to be done in a situation and more focused on the many influences at play. Rich pictures in ADM would be more like soft systems diagrams, which are focused on making plans (Gasson, 1994). Outside of ADM, rich pictures have the potential to show the thoughts, attitudes, and relationships that are present.

Finally, cognitive task analysis (CTA) uses a combination of interviews and observations to elicit knowledge about complex tasks (Clark et al., 2007). A wide variety of CTA strategies and methods are available (Crandall et al., 2006, Table 2.1). Many of these methods have been used with warfighters, including structured interviews, self-reports, and observations (Clark et al., 2007), and the critical decision method to probe incidents related by stories (Hoffman et al., 1998; Klein et al., 1989). Additional techniques that have been used include concept mapping, think-aloud problem solving, and cognitive strategies analysis (Cornelissen et al., 2013: Crandall et al., 2006). The purposes of CTA and RPM are often quite similar, but there is a fundamental methodological difference between them. In most CTA techniques, participants unpack a lived experience by responding to interviewer questions. With RPM, participants unpack their experience by drawing about it, emphasizing the dimensions of the experience that were important to them. It is only after participants have had the chance to immerse themselves in their experiences again without interviewer intervention that they respond to interviewer questions. This makes it more likely that context, tacit knowledge, and unique perspectives are retained.

In summary, the major limitations associated with common knowledge elicitation methods include time constraints, cost, and dependence on expertise of observers and interviewers. Additionally, existing methods do not typically assist participants with making non-linear connections between key features of a situation—a constraint that is particularly troublesome when situations are complex. Finally, traditional interviews and questionnaires tend to capture participants' explicit declarative and procedural knowledge, but not the implicit knowledge that would allow a deeper understanding of their thought processes. Table 1, below, summarizes the advantages and disadvantages of the knowledge elicitation methods that were discussed.

Table 1

Knowledge elicitation methods

Method	Description	Advantages	Disadvantages	Key References
Interviewing	• Structured, semi-Structured, and unstructured • Can be conducted by experts or non-experts	• Provides knowledge about skills and experiences • Can help with problem identification	• Interviewees may skip information if interviewers are experts (assume they have a certain level of knowledge) or non-experts (skip important information that they believe is too complex) • Interview setting intimidating to interviewee	(Berg, 2013; Cristancho, 2015; Cristancho et al., 2015)
Questionnaires	• Surveys of methods used to respond to complex problems	• Gathers a lot of information from a variety of participants Inexpensive	• Open-ended questions create data that are challenging to synthesize and interpret • Misinterpretation is common	(Berg, 2013)
Contextual design/ storyboarding	• Ethnographic method using interviews and observations • Conducted within participant environment	• Utilizes several tools for triangulation of methods (e.g., interviews, observations, diagrams, questionnaires) • Is context-specific	• Easy to make inaccurate assumptions • Participants may not want to be observed	(Berg, 2013)
Army Design Methodology	• Utilizes diagrams and pictures to identify complex relationships that may not otherwise be considered	• Helpful for operational- and strategic-level planning and decision making, particularly in the absence of critical information • Typically contain critical tactical decision points	• Future-focused for planning rather than reflection • Tacit knowledge may not be captured	(Dept. of the Army, 2015)

Table 1 *(continued)*

Method	Description	Advantages	Disadvantages	Key References
Cognitive Task Analysis	• Use of interviews and observations for knowledge elicitation of experts completing complex tasks	• Can be used to observe behaviors and evaluate performance • Helps uncover declarative and procedural knowledge • Provides information about the decision making and cognitive skills required for the task	• Methods are often unclear • Can be expensive • Limited ability to capture implicit knowledge	(Clark et al., 2007)
Rich Picture Methodology	• Participants create a pictorial representation of a problem situation • Method is largely unstructured and the elements of a rich picture are determined by the creator	• Gathers information about both explicit and implicit knowledge • Preserves situation context • Allows for thinking about complex interdependencies non-linearly • Includes the creator's affect, opinions, and concerns	• Participants' perceptions of their ability to draw • Participants perceiving drawing as unprofessional • Researchers misunderstanding rich pictures if they do not conduct follow-up interviews for clarification	(Armson, 2011; Bell & Morse, 2013; Berg, 2013; Cristancho et al., 2015; Monk & Howard, 1998)

Implementing RPM

The instructions provided when conducting RPM are typically open-ended and sometimes vague, leading to differences in the complexity, structure, and use of rich pictures (Berg, 2013; Bronte-Stewart, 1999; Cristancho et al., 2015). Moreover, researchers rarely share the specifics of their procedures in their reports, leaving others to implement RPM in whatever way they have interpreted the literature. For example, some rich pictures make use of computer-generated drawings and fixed sets of icons, whereas others are created using pencil and paper with stick figures (see examples, Cristancho et al., 2015; Monk & Howard, 1998). Bronte-Stewart (1999) notes, "while the originators of SSM [and RPM] give no clear construction advice, other authors proffer quite precise instructions" (p. 83). Although RPM varies on some procedural elements, commonalities include beginning with a blank canvas, minimizing the number of words used, and attempting to include all the factors at play in a situation.

Elements of a Rich Picture

Common elements of rich pictures include structure, artistry, and visual coherence (Berg, 2013). Structure includes the boundaries and richness of the picture; artistry includes colors, metaphors, emotions, and icons; visual coherence includes the narrative, style, and background used (Berg, 2013). Other researchers have looked at additional elements including motion, position, complexity, size, and directionality in rich pictures (Cristancho, 2015). Such elements help researchers analyze the meaning of a rich picture's content and evaluate the thoroughness and quality of a rich picture, which can be used to assess the relevant competencies and expertise of the participant. Figure 1 provides an example of a rich picture.

Figure 1. Example rich picture. From "Using Rich Pictures to Verify, Contradict, or Enhance Verbal Data" by C. M. Booton, 2018, *The Qualitative Report, 23*(11), p. 2840 (https://doi.org/10.46743/2160-3715/2018.3279). CC BY-NC.

More personal and affective elements of a rich picture (e.g., opinions, trust; Bronte-Stewart, 1999) can also be analyzed and interpreted. Cristancho (2015) provides an example of a surgeon's using apples and red arrows to show trust, even though he had not been consciously thinking about trust while drawing the picture. Discussing the picture during the interview phase allowed the surgeon to articulate a concept that was important to the situation but that otherwise would not have been elicited (Cristancho, 2015).

Evaluating Rich Pictures

Some scholars have argued that rich pictures should not be compared to one another for quality but rather only be compared to show similarities and differences. Bell and colleagues (2016) noted that because there is such little structure and so few rules when using RPM, no one picture can be better or worse than another. However, depending on the purpose for using RPM, there are many things that researchers could look for to evaluate the pictures.

Cristancho (2015) looked at specific aesthetic features of rich pictures, such as colors, shapes, lines, and motion, as well as motifs and themes that came out of the relationships among them. This information was then used to draw conclusions about the stories in each picture and to compare stories across pictures. Bell and colleagues (2016) also looked at different types of physical and dynamic elements of rich pictures, leading to their argument that there are two outcomes of RPM: the actual pictures and the learning and reflection that occurs while the pictures were drawn. Post-drawing interviews typically include questions about the elements of the pictures (Young, 2005), and subject matter experts are often used to interpret responses and score the coherence and richness of pictures (Bell et al., 2016; Berg, 2013).

One scale that has been used for evaluating rich pictures is the four subcomponents of coherence: color relevance, kinetics, mood expression, and evidence for addressing the question being asked (Bell et al., 2016). These four criteria are rated by researchers or subject matter experts on a four-point scale from 'incoherent rich picture" to "coherent rich picture" (see Bell et al., 2016; Table 2). A picture that scores higher on color relevance uses several different colors that carry different meanings. The kinetic subcomponent refers to the width and shape of lines that are used in place of words to represent connections and boundaries, while mood expression is represented by clear stories that are either positive or negative in tone. Finally, evidence for addressing the question simply asks whether the rich picture is clearly related to the prompt that was given.

Berg (2013) used similar criteria for evaluation of rich pictures, primarily focusing on richness, kinetics, and coherence of the pictures. Richness occurs when color, boundaries, and lines are used; a clear story is told; and the visual elements used seem to be relevant. Berg's (2013) four-point scale for richness ranged from "very poor picture" to "very rich picture," and was akin to the color relevance criteria from Bell and colleagues' (2016) scale. The extent to which a rich picture was kinetic depended on the use of connectors to tell a story, including their motion, direction, thickness, and size. Finally, Berg's coherence rating was based on the extent to which the picture told a clear story—a story that had very little text yet lacked ambiguity.

Table 2

Criteria for evaluating a rich picture

Criteria	Description
Richness	• Utilizes several visual elements such as color, boundaries, and lines
	• Expresses mood and affect related to the situation
	• Shows a clear understanding of complex relationships
Coherence	• Tells a cohesive story
	• Makes meaningful use of different colors and symbols
Kinetic	• Includes visual connections between actors and nodes in a rich picture
	• Visual connections include arrows in different sizes, shapes, and directions
Relevance	• Picture fully addresses the questions asked in the prompt
	• Picture includes necessary (and excludes unnecessary) details

Using Existing Models and Rubrics to Enhance RPM

The Army's Leader Requirements Model (LRM: Department of the Army, 2019) defines leadership according to what a leader should be and know (*Character, Presence, Intellect*; see Figure 2) as well as what a leader should do (*Leads, Develops, Achieves*). Although RPM could be used to elicit information about multiple LRM attributes and competencies, our research focused on assessing intellect (an attribute) and leadership (a competency). These were chosen for their relevance to the training courses underway at the time of data collection. Showing how RPM can be applied to both attributes and competencies is important, as competencies are thought to be trained and developed, whereas attributes are more enduring and develop through experience (Department of the Army, 2019). Demonstrating that RPM is sensitive enough to capture differences in both is important for exploring the robustness of the approach and its utility to the Army.

Intellect includes sub-attributes, such as *Mental Agility*, *Sound Judgment*, *Innovation*, *Interpersonal Tact*, and *Expertise*; and influences how leaders consider problem situations, draw conclusions, and make decisions (Department of the Army, 2019). Individuals with strong intellect can adapt their behaviors when appropriate, collaborate with diverse individuals, take contingencies into account, and use innovative methods to expand their knowledge (Department of the Army, 2019). *Leads* includes leading others, building trust with followers, leading by example, communicating, and influencing beyond the chain of command. Individuals with strong leadership competencies can empower others, collaborate, maintain cohesion in their groups, and share information (Department of the Army, 2019).

Figure 2. The Army's Leadership Requirements Model. Adapted from Department of the Army Headquarters (2019). *Army leadership and the profession (ADP 6-22)*. Washington, D.C., p. 1-6.

While some aspects of the LRM may be readily observed (e.g., a Soldier is taking the lead or is not), they are more difficult to quantify (e.g., giving a leadership score). Other aspects, such as building trust, are more difficult to assess due to their intangible nature. One way this challenge has been addressed is through the development of a behaviorally anchored rating scale, a rubric associating certain actions with distinct levels of competency attainment (BARS; Toumbeva et al., 2018). In field training exercises, for example, BARS can be used to assist all raters in using the same criteria to classify performance as needs improvement, satisfactory, excellent, or outstanding; ratings that would otherwise be made subjectively. Given that rich pictures are typically not compared because criteria are subjective, the use of a BARS scale to rate the actions depicted in the picture may allow such comparisons to be made. An advantage of RPM is its potential to elucidate the implicit knowledge experts have acquired; comparing pictures can provide feedback to novices that would otherwise be unavailable. Without actionable feedback, a Soldier can be at a loss as to how to "be a better Leader."

Thus far, the theoretical foundations, existing use cases, and potential outcomes of RPM have been discussed. Additionally, how RPM is conducted and evaluated was reviewed. The following section describes how the research team used RPM in two studies within two Army training courses. Study 1 focused on the *Intellect* and *Leads* components of the LRM, while Study 2 more directly focused on the *Builds Trust* subcomponent of the *Leads* dimension.

Study 1: Problem-solving

The main purpose of the data collection was to investigate the efficacy of RPM in the Army context, (i.e., with active-duty Soldiers who were instructors and students from an Army training course). Our main research question was whether RPM could provide evidence of differences between novice (student) and expert (instructor) competency development. A secondary question was whether RPM could provide a quick and effective tool to facilitate reflection and self-learning, key elements of the Army's professional military education (PME) model that often do not receive adequate attention in a fast-moving environment. Specifically, the prompt used for this study was intended to evaluate participants on the *Intellect* and *Leads* components of the LRM.

Method

Participants

Two course instructors, one past student, and one future student participated in the research. All participants were male. Course instructors were contacted by the research team and invited to participate. The course instructors recruited the additional student participants.

Procedure

Upon arrival, participants were seated at a table with large sheets of blank paper and colored pencils. Participants were also presented with a project summary and a demographics form. The researchers thanked the participants for their time, provided a brief overview of RPM and its potential relevance to the Army, and asked for permission to audio record the interview portions of the session. Then, a researcher read from a script (Appendix A) to introduce the process for drawing a rich picture. Participants were then given 25 minutes to draw a rich picture in response to the prompt, "Recall the most challenging problem you've had to solve during your Army career." After drawing for 15 minutes, all four participants were interrupted, and photographs of their pictures were taken. Then, participants were asked to read a follow-up question (Appendix A): "Knowing what you know now about the situation, how might you have acted differently?" Participants were given an additional 10 minutes to work on their drawings with this question in mind. Photographs were taken again at the end of the drawing session, and each participant was paired with a researcher for follow-up, semi-structured interviews. The entire data collection was completed in one hour.

Two sets of interview questions were asked of each participant, and each interview was audio recorded. The first set of questions focused on the participants' drawings, and the second set focused on the participants' experiences with RPM. Example questions included, "Would you please describe your role in the picture?" and "Did you find this exercise to be useful? Why or why not?" (See Appendix A for the full list of questions). To protect participants' privacy, a sample rich picture is not provided here.

Analysis

Key elements of rich pictures include symbols, color, and configuration (Bell et al., 2016; Berg, 2013; Cristancho, 2015). These elements were identified and compared across pictures; Army subject matter experts also informed the analyses to identify important elements that were and were not considered in the pictures (Cristancho et al., 2015). The BARS of *Builds Trust* (Toumbeva et al., 2018, p. A-7) was used to rate the expertise level demonstrated by the drawer; those whose pictures contained indicators in the excellent and outstanding categories were rated as experts, while participants whose pictures contained indicators in the satisfactory and needs improvement categories were rated as novices. Behavioral indicators related to building trust include but are not limited to: (a) establishes conditions that foster a positive command climate; (b) proactively seeks input from others; (c) anticipates and preemptively addresses problems that undermine trust; (d) follows through on obligations; and (e) addresses problems in the unit before they escalate.

Results

Elements of the Rich Pictures

Symbols

During the current study, symbols were sometimes used to represent perspectives, feelings, and relationships between elements of the situation. For example, one participant drew about being the person responsible for having to take a disciplinary action against a Soldier in his unit. The drawer included an image of himself with a devil on one shoulder and an agnel on the other. The angel and devil represented the conflicting perspectives he had about the situation. There were also question marks surrounding the devil and angel, representing the participant's decision-making process. Another participant used symbols throughout his picture to represent the people involved, such as using a fire flame to represent an authority figure.

Color

Rich pictures are often colorful, with different colors used to represent different emotions, perspectives, or stakeholders. Several of the participants used color to show dimensionality in their picture, such as a boot drawn in brown or a woman with blonde hair. Color was also used to represent emotions and perspectives, as in one picture where red indicated conflict and yellow indicated contentment.

Configuration

Three of the four participants used a timeline to organize their pictures, a surprising outcome given that example rich pictures found in the literature do not feature timelines. In fact, the nonlinear nature of RPM is one of its advantages in capturing implicit knowledge. However, the literature does not provide the actual instructions used to inspire the pictures; for that reason, we could not determine whether the configurations were unique to our participants or were a

result of our not specifically precluding the use of timelines in our prompt. For Study 2, participants were directly instructed to avoid using a timeline.

Leadership Competencies in Rich Pictures

The prompt was designed to elicit information about the *Leads* competency and the *Intellect* attribute of the LRM, and the resulting pictures included elements of both. A picture about deciding whether to take disciplinary action against a highly valued team member, for example, included *Builds Trust* (an element of *Leads*) and *Mental Agility*, *Interpersonal Tact*, and *Sound Judgment* (elements of *Intellect*). This participant was also deemed to have shown expertise related to building trust, as the picture demonstrated several behaviors in the BARS excellent category (e.g., anticipates and preemptively addresses problems that undermine trust, following through on obligations). A participant whose drawing was classified as novice specifically reported having trouble thinking of a situation to draw. He finally decided on a time he was tasked with arranging target training for his unit. The training was ultimately successfully conducted, but he failed to anticipate problems that could have been avoided. The participant repeatedly explained complex phenomena in the interview that were not actually included in the picture. This implies that the participant was responding to being questioned, but he had not previously conceptualized the problem in that way.

Lessons Learned in Applying RPM

Prompt

Only one participant reported having trouble identifying a situation to draw and explained that the event did not seem significant enough to be identified as a "problem." However, the participant did produce a picture within the time allotted. The challenges that researchers encountered in comparing the pictures to one another implied that the prompt should be constrained (i.e., the Study 1 prompt had targeted the LRM too broadly). Therefore, the prompt for Study 2 was written to focus on the more granular *Builds Trust*, an element of *Leads* in the LRM. Instructions were also revised to discourage the use of timelines.

Procedure

Participants reported that being interrupted after 15 minutes encouraged additional self-reflection, though their drawings were well underway at that point. It was suggested that it would be better timing to interrupt earlier in the process—at eight minutes rather than 15—while participants were still considering what to include in their rich pictures. Researchers had noted that the drawings generally centered on emotional topics with intricate social relationships, but that this was stressed more in the interviews than in the pictures. Thus, the drawing session in the second study was interrupted with, "If you have not been doing so already, please carefully consider your thoughts and feelings related to the situation you are describing and include them in your picture however you best see fit."

Considerations Specific to Application in the Army

Rather than feeling resistant or uncomfortable drawing a picture, three of the four participants reported enjoying the process. They appreciated drawing as a break from the writing they are typically asked to do, remarking that it made them think more figuratively as they sought to express an event in a way that others could interpret. The other participant expressed ambivalence but did say the process could be useful in explaining an event to others more quickly. The only area of special consideration discovered was in the wording of the prompt. Words like "problem" and "challenge" may imply a level of difficulty that Soldiers tend not to attribute to a situation. In Study 2, "problem" was replaced by "barrier." Because participants in our first study had no discomfort with the methodology, participants in Study 2 were asked only about their rich pictures; they were not asked about their experience with the methodology.

Study 2: Building Trust

The purpose of Study 2 was to identify (a) what information Soldiers consider when trying to build trust; (b) if differences in expertise regarding *Builds Trust* were present in the Soldiers' rich pictures; and (c) whether experts and novices use different trust-building strategies and engage in different types of trust-building behaviors.

Method

Participants

Four Army course instructors with varying levels of advising experience participated in the second study. All participants were male.

Procedure

The procedure was largely like that of Study 1, except those lessons learned were incorporated as described above. No changes were made to the analysis protocol. See Appendix B for the full prompt.

Results

Elements of the Rich Pictures

Symbols

As in Study 1, symbols were used to represent complex ideas metaphorically. For example, one participant drew about his efforts to build trust and rapport with foreign Soldiers and included a piece of equipment that represented a divide in perspectives between two groups that were having trouble working together. Although the equipment was literally a weapon, figuratively it showed that the groups were going to react differently to the same situation and required special considerations in attempting to build trust.

Color

Participants once again made use of colors. For example, one participant used color to show how the mood of the people involved changed as the event unfolded. Another participant chose not to use any color, explaining that he wanted to have the option to erase parts of his drawing.

Configuration

Although timelines were still used in two drawings, participants used that structure more strategically. For example, one picture featured different time blocks, but the blocks were used to represent each pivotal moment that threatened trust in the situation. Similarly, the drawer of the colorful picture described above used time blocks so that he could use different colors for each one, representing the changing mood over time.

Leadership Competencies in Rich Pictures

One research question was whether RPM could be used to distinguish experts from novices based on what they included in their pictures. Tailoring the prompt to *Builds Trust* allowed researchers to detect greater variation in the pictures related to differences in competency development. Novice drawings again tended to be literal, depicting an event as it unfolded but not detailing how the events related to the building of trust. In interviews, novices tended to describe what happened factually and sequentially. They made indications that they understood the concept at hand (i.e., trust), but did not dig deeply into the actions, relationships, or perspectives that may have helped or hurt the situation.

Expert drawings, on the other hand, focused much less on the specific events that occurred. Instead, they depicted the stakeholders they were considering and the relations of different elements of the pictures to building and maintaining trust. In interviews, experts spoke much more about the nuances of the social relationships involved. For example, one participant emphasized that he was constantly monitoring the foreign forces his team was working with for any cues (e.g., watching facial expressions, listening to verbal tones) that might indicate a loss of trust and the need to change his actions. Another participant explained that each item in his drawing played a part in how he built trust with the host nation officers through his words and personal conduct. Further, his picture included several key environmental elements, their scale, and their importance to each other and to the organization of the community. Finally, experts were more reflective when asked what additional information they would have wanted about the situation in the drawing. While novice participants simply stated that they wished they had known what the outcome was going to be, experts desired social information that could have helped them, such as more clearly understanding another person's feelings.

Discussion

As expected, the results of both studies showed the same elements of rich pictures that previous studies have identified (e.g., the use of colors, metaphors, emotions, and icons). Unlike other rich pictures in the literature, however, these drawings featured timelines. Whether this is specific to military participants should be explored in future research. Despite this more linear configuration, the pictures did spur reflection and reveal implicit connections. The act of drawing—no matter how skilled the drawer—and discussing the picture with a "coach" allowed participants to introspect and consider the situation from a more meaningful and less literal perspective. Communicating using symbols rather than words helped not only the drawer but also the audience to understand the event more holistically. Participants commented that RPM could be used to impart instruction through the drawing of a story, and that this could be accomplished more quickly than in writing.

The ability to integrate seemingly isolated variables (e.g., objects in a rich picture) into complex patterns that are accurate and relatively automatic is a hallmark of expertise (Glaser, 1976). In using the BARS for *Builds Trust* (Toumbeva et al., 2018), we demonstrated a unique and principled method for comparing rich pictures as exemplars of the drawer's mastery of the topic. This allowed not only the distinction between novices and experts, but also provided a potential tool for capturing these distinctions for use in assessment and development.

Of note, a gap in the RPM literature is that very few studies provide any detail about the actual prompts that were used to initiate the drawing, creating challenges for replications of RPM studies. Authors may discuss how they instructed participants to draw (e.g., use color, include yourself in the picture) and how the pictures were analyzed, but much of the information is not detailed and key details are missing. For example, Berg (2015), who provides more information than most, noted the prompt was, "the complexities of University life" (p. 74). An important contribution of our research is that we have provided the specific materials that were used, as well as the lessons that we learned while implementing RPM.

Conclusions and Recommendations

This research demonstrated an interesting and novel approach to knowledge elicitation that could be useful in several Army contexts. Although the sample size was limited, these exploratory studies provided evidence that RPM can be used in the assessment and development of leader competencies. Rich pictures produced by Soldiers showed many of the same elements as previous RPM studies except that the configuration tended toward a timeline. Future studies should investigate RPM with a larger sample to determine if these results replicate.

The rich pictures participants produced provided information that is often missing from traditional knowledge elicitation methods, such as reflections on emotions, relationships, and diverse perspectives. Because we found that changes to the procedure were accompanied by changes in the pictures that were drawn, we recommend future research that aims to refine these elements of the methodology. Narrowing the construct of interest and using an accompanying performance measure enabled the use of a principled approach to compare the drawings in terms

of expert-novice competency development. These distinctions may provide instructors with graphic evidence of what students know and do not know by comparing their drawings with one the instructor produced. An additional benefit may be that the instructor discovers tacit knowledge that he or she is then able to convey to students. Moreover, using RPM with an accompanying performance measure could help to guide feedback to the student in a doctrinally supported way. For these reasons, future research should examine RPM in an Army schoolhouse setting.

One of the greatest impediments to effective coaching/counseling is when the coach or counselor tries to solve the problem or give too much advice (Stanier, 2016). Often, these professionals do this because they assume they know what is going on or what the problem is when in fact they do not. Given this, we also recommend that RPM be used in coaching/counseling and mentoring sessions. By creating a rich picture in response to a prompt, a Soldier would allow the mentor to see a situation the way the Soldier sees it, including errors in framing and other previously unarticulated yet still contributing factors. In turn, the mentor could target feedback in a way that is particularly relevant to the Soldier.

Although some challenges were anticipated, such as reluctance to participate due to self-consciousness about drawing ability (Avison & Fitzgerald, 2003), no such challenges arose. However, limited time to draw rich pictures and engage in follow-up interviews are likely to be obstacles to using RPM in the Army. One way this can be overcome is to include RPM as a component of courses or processes that already occur, such as assessment and coaching/mentoring sessions.

Enabling the more efficient and proficient use of RPM requires that practitioners disclose their research materials—including prompts, instructions to participants, and any lessons learned that may help to refine prompts, procedure, and/or analyses. A thorough search of the literature confirmed that this is a significant gap. By sharing our research materials, we hope to provide inspiration to other researchers interested in using RPM to capture previously elusive tacit knowledge.

References

Armson, R. (2011). *Growing wings on the way: Systems thinking for messy situations*. Triarchy Press.

Avison, D., & Fitzgerald, G. (2003). *Information systems development: Methodologies, techniques and tools* (3rd ed.). McGraw Hill.

Bell, S., & Morse, S. (2013). Rich pictures: A means to explore the "sustainable mind"? *Sustainable Development*, *21*(1), 30-47. https://doi.org/10.1002/sd.497

Bell, S., Berg, T., & Morse, S. (2016). *Rich pictures: Encouraging resilient communities*. Routledge.

Berg, T. (2013). *Understanding iconography: A method to allow rich picture interpretation to improve* [Doctoral dissertation, Heriot-Watt University].

Berg, T. (2015). Rich picture: The role of the facilitator. *Systemic Practice and Action Research, 28*(1), 67-77.

Boardman, J., & Sauser, B. (2008). *Systems thinking: Coping with 21st century problems*. CRC Press.

Booton, C. M. (2018). Using rich pictures to verify, contradict, or enhance verbal data. *The Qualitative Report, 23*(11), 2835-2849. https://doi.org/10.46743/2160-3715/2018.3279

Bronte-Stewart, M. (1999). Regarding rich pictures as tools for communication in information systems development. *Computing and Information Systems*, *6*(2), 85-104. https://doi.org/10.1207/s15326985ep4001_1

Checkland, P. (1981). *Systems thinking systems practice*. John Wiley.

Checkland, P. (2000). Soft systems methodology: A thirty-year retrospective. *Systems Research and Behavioral Science, 17*(S1)*,* S11-S58. https://doi.org/10.1002/1099-1743(200011)1\:1+<::AID-SRES374>3.0.CO;2-O

Clark, R. E., Feldon, D., van Merrienboer, J., Yates, K., & Early, S. (2007). Cognitive task analysis. In J. Spector, M. D. Merrill, J. J. van Merrienboer, and M. P. Driscoll (Eds.) *Handbook of research on educational communications and technology* (3rd ed.). Lawrence Erlbaum Associates.

Cornelissen, M., Salmon, P. M., McClure, R., & Stanton, N. A. (2013). Using cognitive work analysis and the strategies analysis diagram to understand variability in road user

behavior at intersections. *Ergonomics, 56*(5), 764-780. https://doi.org/10.1080/00140139.2013.768707

Crandall, B., Hoffman, R. R., & Klein, G. A. (2006). *Working Minds: A Practioner's Guide to Cognitive Task Analysis*. MIT Press.

Cristancho, S. (2014). What can we learn from a soft sister? A complementary lens to the systems engineering approach in medical education research. *Medical Education, 48*(12), 1139 -1141. https://doi.org/10.1111/medu.12617

Cristancho, S. (2015). Eye opener: Exploring complexity using rich pictures. *Perspectives on Medical Education, 4*(3), 138-141. https://doi.org/10.1007/s40037-015-0187-7

Cristancho, S., Bidinosti, S., Lingard, L., Novick, R., Ott, M., & Forbes, T. (2015). Seeing in different ways: Introducing "rich pictures" in the study of expert judgment. *Qualitative Health Research, 25*(5), 713-725. https://doi.org/10.1177/1049732314553594

Cristancho, S., Lingard, L., Forbes, T., Ott, M., & Novick, R. (2017). Putting the puzzle together: The role of "problem definition" in complex clinical judgment. *Medical Education, 51*(2), 207-214. https://doi.org/10.1111/medu.13210

Dennis, M. B. (2010). *Systems thinking and design: Making learning organizations a reality in the U. S. Army.* United States Army Command and General Staff College, School of Advanced Military Studies.

Gasson, S. (1994). *The use of soft systems methodology (SSM) as a tool for investigation.* Warwick Business School.

Glaser, R. (1976). Cognition and instructional design. In D. Klahr (Ed.), *Cognition and instruction* (pp. 303-315). Lawrence Erlbaum Associates.

Guillemin, M. (2004). Understanding illness: Using drawings as a research method. *Qualitative Health Research, 14*(2), 272-289. https://doi.org/10.1177/1049732303260445

Hoffman, R. R., Crandall, B., & Shadbolt, N. (1998). Use of the critical decision method to elicit expert knowledge: A case study in the methodology of cognitive task analysis. *Human Factors, 40*(2), 254-277. https://doi.org/10.1518/001872098779480442

Klein, G. A., Calderwood, R., & MacGregor, D. (1989). Critical decision method for eliciting knowledge. *IEEE Transactions on Systems, Man, and Cybernetics, 19*(3), 462-472. https://doi.org/10.1109/21.31053

Klein, G. A. (1997). Developing expertise in decision making. *Thinking and Reasoning 3*(4), 337-352.

Klein, G. A., & Hoffman, R. R. (1992). Seeing the invisible: Perceptual-cognitive aspects of expertise. In M. Robinowitz (Ed.), *Cognitive Science Foundations of Instruction* (pp.203-226). Lawrence Erlbaum Associates.

LaFrance, M. (1989). The quality of expertise: Implications of expert-novice differences for knowledge acquisition. *ACM SIGART Bulletin, 108*, 6-14. https://doi.org/10.1145/63266.63267

Monk, A., & Howard, S. (1998) Methods & tools: The rich picture: A tool for reasoning about work context. *Interactions, 5*(2), 21-30. https://doi.org/10.1145/274430.274434

Stanier, M. B. (2016). *The Coaching Habit: Say Less, Ask More and Change the Way You Lead Forever.* Box of Crayons Press.

Stowell, F. A., & West, D. (1994). "Soft" systems thinking and information systems: A framework for client-led design. *Information Systems Journal, 4*(2), 117-127.

Toumbeva, T. H., Ratwani, K. L., Diedrich, F. J., Flanagan, S. M., & Uhl, E. R. (2018). *Development of a behaviorally anchored rating scale for leadership* (Research Product 2018-06). United States Army Research Institute for the Behavioral and Social Sciences. (DTIC No. AD1048729).

U.S. Department of the Army. (2015). *Army design methodology (ATP 5-0.1)*. Author

U.S. Department of the Army. (2019). *Army leadership and the profession (ADP 6-22)*. Author.

Weiss, R. (1994). *Learning from strangers: the art and method of qualitative interview studies.* The Free Press.

Young, Jr., W. E. (2005). *Discovering the effects-endstate linkage: Using soft systems methodology to perform EBO mission analysis.* Unites States Air Force, Air Command and Staff College.

Appendix A

Study 1 Materials

Experimenter Script

Thank you for participating in this project. Today you will be asked to draw a picture about an experience you have had in the Army. You will be given a prompt, and you will have 25 minutesto draw your picture.

The picture can be structured in any way that you want, but be sure to include yourself in thepicture, along with the important features, including objects, people, events, procedures, concepts, feelings, and organization, social, and personal factors you had to consider.

Use colors. Do not just draw static stick figures—show people and objects doing something and include the context in your drawing (e.g., where they are, and why). Show interactions, relationships, and connections between people and objects. Include metaphors and/or symbols if you want. Make it a rich, detailed representation. Do not use many words—only use words when necessary, such as for labels or an exclamation in a speech bubble. Do not write sentences that need to be read. Make sure that you put yourself in the picture.

Please find the prompt on the desk in front of you. You may now review it and begin drawing.You will have 25 minutes.

[After 2-3 minutes]: If you have not begun drawing yet, you should do so now.

[After 15 minutes of drawing]. Please take a minute to come to a pausing point for your picture.You do not need to finish your picture, just finish your thought.

[After a minute]: We are now handing you a piece of paper with an additional question for you toconsider as you finish drawing your picture.

You now have 10 more minutes to complete your picture.

Participant Handout #1

Prompt: Recall the most challenging problem you've had to solve during your Army career.

Please draw a picture describing the situation, the actions you took, and the result of your actions. Include the important features, including people, procedures, and Army concepts that influenced the situation, your decisions, and the outcome. What were the relationships that influenced your actions?

Participant Handout #2 (After 15 minutes of drawing)

Consider the following question as you complete your picture. You will have ten more minutesof drawing time.

1) Knowing what you know now, what would you do differently if you had it to do again? Why?

Post-Drawing Semi-Structured Interview Questions

Describing the Picture

1) Briefly describe your picture.

2) Briefly describe your role in the picture. Did you hold a specific leadership position at the time?
3) What actions did you take to solve this problem?
4) What was the ultimate outcome of your actions?
5) Knowing what you know now, what would you do differently if you had it to do again? Why?
6) If you could have had one additional piece of information to solve this problem, what would that have been?
7) What were the social relationships and your thoughts and feelings that influenced your actions?

Thoughts about RPM

1) Tell me about your experience drawing a rich picture.
2) What did you like/dislike about drawing a rich picture?
3) Did you find this exercise to be useful? Why or why not?
4) **If interviewing an instructor:** How else might you use RPM? **[If need additional prompting]:** For example, would you consider using it in another classroom, using another prompt/scenario, or using it for another purpose such as for information sharing? How does this compare to other methods you use?
5) **If in Group 2 (group with additional question):** How did you feel about being interrupted to be given and additional question to consider while you were drawing? Was that question helpful for you when drawing your picture? Why or why not?

Demographics

INSTRUCTIONS: The information below is for research purposes only and will help the Army better understand how groups of individuals perceive their level of inclusion in the military.

Your information will not be reported at the individual level. You may participate (or not) to the extent you feel comfortable.

1. Which, if any, leadership position do you **currently hold**?

☐ Company Commander

☐ Company XO

☐ Company 1st SGT

☐ Platoon Leader

☐ Platoon Sergeant

☐ Squad Leader

☐ Team Leader

☐ None of the above

2. If you are in one of the leadership positions listed in #1, how many months have you been in your current position?_____months

3. Have you ever been deployed?

☐ Yes ☐ No

4. Have you served on staff previously?

☐ Yes ☐ No

5. Have you completed the MCCC?

☐ Yes ☐ No

6. Are you an instructor or a student?

☐ Yes ☐ No

Appendix B

Study 2 Materials

Experimenter Script

As researchers, we often collect verbal data from interviews or focus groups. When interviewing people about their thinking processes, it is difficult to elicit what psychologists call tacit knowledge—that is, all the things that you understand, but that you may not be able to verbalize. Rich pictures methodology was developed to get around the limitations of standard verbal interviews for eliciting information about thinking processes. No special talents are required to draw a rich picture. Just as we all did drawings when we were children, we are all able to produce a rich picture.

Please recall a time when you experienced a barrier to building trust with someone. This couldbe a Soldier(s) in your unit or that you had to work with. If you do not have a military situation to draw from, please use whatever situation comes to mind.

Please draw a picture describing the **pivotal moment** in the situation, the actions you took, and the result of your actions. Include the important features, including people, procedures, and Army concepts that influenced the situation, your decisions, and the outcome. What were the relationships that influenced your actions? What were your thoughts and feelings associated with the interaction?

Your goal is to represent everything you experienced about the problem situation you selected. Use colors. Don't just draw static stick figures—show them doing something and include the context (where they are doing that something and why). Show interactions, relationships and connections. Include metaphors and/or symbols if you want. Make it a rich, detailed representation. Don't use many words—just use words as labels or an exclamation in a speech bubble, but not as a sentence that needs to be read. Make sure that you put yourself in the picture.Try to represent the problem situation in its entirety. Photos of your drawing will be taken mid- way and upon completion of your drawing using government cell phone cameras.

After you've completed your picture, I'll ask you to walk me through it so that I understand whatyou have drawn. I will take some notes so that I can remember our discussion and will record the interview if you are willing to allow me to do so. Any recording will be deleted after it has been transcribed." [If a participant indicates that s/he prefers not to be recorded, the researcher will state that it is fine to proceed with just note-taking.]

Before beginning, the researcher will add: Before we begin, please note this is an unclassified setting; please be mindful of your obligations to protect sensitive/classified information. Also, please be aware of your rights as a participant in research. You can choose not to participate at any time, and you can choose not to answer any question you do not want to answer—without penalty. There is very low risk associated with your participation in this research. The aggregated results from the data you and your colleagues provide will enable ARI to refine rich pictures methodology as an interviewing technique we may utilize in future research."

[After 8 minutes of drawing]. *Take pictures of Rich Pictures in their current state.* `

If you have not been doing so already, please carefully consider your **thoughts** and **feelings** related to the situation you are describing and include them in your picture however you best see fit.

Participant Handout

- Include **yourself** in the picture
- Use **color**
- Your project **does not need** to be formatted chronologically (you do not need to draw a timeline)
- Focus on the **pivotal moment**
- Include information about **social relationships**
- **Try not to** write sentences; only use words and short labels if necessary

Prompt: Recall a time when you experienced a barrier to building trust with someone.

Please draw a picture describing the **pivotal moment** in the situation, the actions you took, and the result of your actions. Include the important features, including people, procedures, and Army concepts that influenced the situation, your decisions, and the outcome. What were the relationships that influenced your actions? What were your thoughts and feelings associated with the interaction?

1) **Post-Drawing Semi-Structured Interview Questions** Briefly describe your picture.
2) Briefly describe your role in the picture. Did you hold a specific leadership position at the time?
3) What was the pivotal moment in this scenario?
4) What were you overriding concerns at this point?
5) What were your goals at this point? How were they different from your goals at the beginning of the scenario?
6) What historic information did you use to understand the situation?
7) What cues or information were you monitoring during this situation?
8) What were the social relationships and your thoughts and feelings that influenced your actions?
9) Did you consider any other courses of action during this event? Why didn't you choose those?
10) Might someone else in the same position have done it differently?
11) **[If there's anything they clearly left out]**: Why didn't you include__ in your picture?
12) How would you coach someone who found themselves in a similar situation?

Demographics

1. What is your MOS? _____
2. What is your Rank? _____
3. What is your time in grade?_____Years_____Months
4. What is your current (or most recent) assignment/role?_____
5. How long have you been in your current assignment/role?____Years___Months
6. How long have you been in the Army?____Years_____Months
7. How many times have you deployed?_____(if no deployments, please enter "0")