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## Unlocking the Methodology Of Escape Rooms: Considerations For Conducting Applied Escape Rooms in Research

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## Abstract

*Background.* Teams are the foundation of modern organizations. Many organizations are interested in interventions to bolster the effectiveness of their workforce. One viable intervention is an escape room. Escape rooms are engaging, team-based activities that require individuals to work together to complete multiple tasks in a limited amount of time.

*Purpose.* The purpose of this article is to provide ten considerations that are relevant to leveraging escape rooms as a means for data collection. Specifically, we offer guidance regarding pilot testing, equipment set-up, participant recruitment, briefing participants, progress monitoring, hints, room maintenance, data maintenance and analysis, and revising the room and study.

*Conclusion.* The considerations provided in this article can assist researchers when attempting to employ an escape room as a mechanism to collect data.

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## Keywords

escape rooms, research methodology, co-operative games, simulation/gaming

Teams are the foundation of modern organizations especially in domains such as healthcare, aviation, and transportation (Salas et al., 2018). Many organizations are interested in interventions, such as escape rooms, to bolster the effectiveness of their workforce.

Escape rooms are engaging, team-based activities that require individuals to work together to complete multiple tasks in a limited amount of time (Nicholson, 2015). Participants are “locked” in a limited space until they complete the steps necessary to ‘escape the room’ before a time limit runs out. Escape rooms have been effectively utilized to deliver technical skills training (e.g., computer programming – López-Pernas et al., 2019; disaster preparedness – Novak et al., 2019; patient safety – Backhouse & Malik, 2019; medication safety – Sarage et al., 2021) as well as improve non-technical outcomes (e.g., group cohesion – Cohen et al., 2021; team orientation – Gordon et al., 2019; teamwork skills – Valdes et al., 2021; Zhang et al., 2018). Despite their increasing utilization, more guidance is needed to advance escape room methodology in research.

Prior work has described theoretical considerations for escape rooms’ use in conducting teams research (Cohen et al., 2020) and detailed the initial steps of applied escape room development (Doherty et al., 2022). Although this earlier work provides the necessary guidance on how to develop an applied escape room especially in the context of research, questions remain unanswered regarding escape room methodology before, during, and after data collection. Therefore, the purpose of this manuscript is to provide considerations to support escape rooms’ use in applied research before data collection has begun, as data is being collected, and once data collection has been completed (see Table 1 for an overview).

**Table 1.** Considerations for Escape Room Development Before, During, and After Data Collection.

Time period	Related considerations
Before data collection	<ol style="list-style-type: none"> <li>1. Testing the room</li> <li>2. Setting up equipment and behavioral metrics</li> <li>3. Recruiting, coordinating, and selecting participants</li> <li>4. Pre-Briefing individuals</li> </ol>
During data collection	<ol style="list-style-type: none"> <li>1. Monitoring individuals</li> <li>2. Providing hints</li> </ol>
After Data collection	<ol style="list-style-type: none"> <li>1. Resetting and maintaining the room</li> <li>2. Checking the integrity of data</li> <li>3. Analyzing data</li> <li>4. Altering the room and study (if necessary)</li> </ol>

These considerations assume that the reader has developed an escape room and is ready to begin pilot testing data collection procedures. Relying on this assumption, the following sections will detail considerations for employing an escape room for the purposes of collecting data for research.

## Before Data Collection

Before data collection refers to the period prior to participants arriving at the actual escape room. There are certain facets of an escape room that warrant scrutiny. Specifically, it is important that researchers test the room to anticipate difficulties in running participants, that data capture equipment is configured to ensure high quality data is collected, that procedures are established to efficiently recruit, coordinate, and select participants, and that participants will be adequately pre-briefed before the escape room.

### *Consideration 1. Testing the Room*

Problems can arise with the implementation of an escape room that can adversely influence the effectiveness of the activity before data collection begins. Therefore, all escape rooms should undergo pilot testing before they are launched. Pilot testing is typically a small-scale study that precedes a larger, full-scale undertaking to facilitate planning and decision making as well as mitigating potential problems and risks (Fraser et al., 2018).

Generally speaking, there are four reasons to conduct a pilot study: *process*, *resources*, *management*, and *scientific* (Thabane et al., 2010). *Process* refers to the feasibility of the steps involved with executing the study such as how participants are recruited to complete the escape room. *Resources* refer to the capacity to determine issues related to time and budget such as how long it takes participants to navigate all of the puzzles and actually escape. *Management* alludes to potential problems relating to personnel or data management (e.g., the logistics of tracking and linking any video data and survey data). Finally, the *scientific* aspect includes any issues regarding the intervention such as the number or difficulty of puzzles.

Regardless of the reason, it is pragmatic to conduct the pilot tests with the actual resources that would be employed for the full study (e.g., the research team, metrics, location, and equipment). Further, one should also plan on recruiting from the target research population. The amount of people recruited for a pilot study is not necessarily based on hypothesis testing or inferential statistics, rather, it is based on recruitment logistics and the necessities of establishing feasibility (Leon et al., 2011). Given there is no consensus, the appropriate sample size for the pilot study will likely be based upon being able to effectively launch for the full-scale effort.

### *Consideration 2. Setting Up Data Capture Equipment and Behavioral Metrics*

Behavioral data can prove to be a wealth of information. To be effective, though, data capture tools need proper set-up. Simply put, observation equipment should be carefully configured to facilitate data collection. Cameras should be positioned to keep participants visible for the duration of the activity, which can be achieved by using multiple static cameras or cameras capable of zooming or panning. One or more microphones can be utilized to record participants' verbal interactions and should be positioned such that all participants can be heard. To preserve audio clarity, microphones should be distanced from sources of noise (e.g., intercoms or air conditioning vents). Lapel microphones can ensure verbal utterances are recorded while mitigating data loss from sources of noise. Data collected from multiple sources may need to be collated, such as compiling multiple audiovisual feeds into a single file. The quality of collected data should also be reviewed before formal data collection procedures begin; collected data is not useful if it is corrupted, unintelligible, or otherwise inaccessible.

In addition to the audiovisual equipment, the actual data collection tools need consideration as well. Ideally, the behavioral metrics are based on the goal(s) of the project. For example, if an escape room's puzzles require technical knowledge to solve, the number of puzzles solved, or time taken to escape can describe whether participants demonstrated technical knowledge. Researchers should consider whether their metrics can adequately capture participants' behaviors and whether participants have ample opportunities to demonstrate the targeted behaviors. Observers should also be trained before data collection begins and procedures should be defined a priori, such as the management of data per trial (e.g., storing and reviewing data digitally or via paper-forms). Operational definitions of behaviors should be provided to prevent ambiguity in scoring and support a shared understanding of the targeted behaviors. Depending on the anticipated sample size of participants, it may be necessary to recruit multiple raters. Two raters per participant trial will be required to assess inter-rater reliability from observations performed in real-time or via recordings. Real-time observations necessitate clear scoring instructions and vigilance; as the number of behaviors under observation increases, the workload of observers increases in parallel.

### *Consideration 3. Recruiting, Coordinating, and Selecting Participants*

Before recruiting teams to participate in the escape room experience, one must determine the number of escape room slots they plan to have available. Each slot should be timed to account for any pre-escape room activities (e.g., signing of consent forms, completing a pre-escape room orientation, participating in surveys/questionnaires), participation in the escape room activity, and post-escape room activities (a post-participation debrief, extraction of necessary data, and room reset). When possible, escape room slots should include a buffer of time between one group and another to allow for troubleshooting of potential failures that may present during one session (e.g.,

puzzle replacement, battery charging, camera/microphone failures) and rest of the escape room staff.

Once these logistics are determined, recruitment and coordination can take place. Initial recruitment documents should include information about the required team size, costs for participation if any, pre-requisites for participation (e.g., pre-escape room survey completion, certain level of education necessary, specific background requested etc.), and instructions for getting in contact with the escape room coordinator (e.g., for intact teams, one participant of the interested team might reach out with team member names). Once teams have expressed an interest in participation, pre-screening of participants can be achieved by administering surveys and confirming that interested participants match pre-defined characteristics to move forward with scheduling.

When scheduling teams, researchers should provide directions to the space, a contact number or email in the event that participants are running late, information related to consequences of late arrival/failure to arrive, and time required for participation. Once an escape room session is scheduled, researchers should schedule reminders, follow up with participants regarding pre-escape room documents and confirm that all team members are available prior to the scheduled activity time. Scheduled sessions will also need to be coordinated among other escape room team members (e.g., game mangers, note takers).

#### *Consideration 4. Pre-Briefing Individuals*

Upon arrival to the escape room, the escape room researcher should greet participants and ensure they are all members of the correct team, answer any questions, and provide a pre-briefing so they know what to expect before engaging in the activity. The pre-briefing should include information on rules, safety, locks and puzzles, room progression, and hints. Rules describe appropriate behaviors (e.g., working together, touching props, moving things out of the way) and inappropriate behaviors (e.g., breaking items, forcing locks to open, manipulating objects that say, 'do not touch', standing on or climbing props, using personal cellphones). Participants should be made aware of safety considerations such as what to do in the event of an emergency, how to leave the room, and safety hazards in the environment (e.g., heavy equipment, electrical outlets, tripping hazards). Given that some participants may have never encountered some of the locks used in the escape room, it can be useful to demonstrate different lock types (e.g., padlock vs. key lock vs. character passcode vs. laser lock) and how they function. With respect to room progression, participants should be made aware of time limitations, if elements of prior puzzles will be reused at any point, and if there will be multiple rooms. Participants should also be made aware of information that exists in the room that is not intended to be utilized in the experience (e.g., barcodes on the bottom of furniture, participant ID numbers, microphones/cameras) so they don't get off track. Finally, participants should receive instructions on hint utilization including the number of hints they have, how they should be requested, and when they can be used.

Pre-briefings can be delivered using a script or may be pre-recorded and presented using a video to reduce researcher fatigue and ensure consistency and standardization of the instructions provided. Once participants have been briefed, the researcher can provide costumes, assign participant ID numbers, and bring them into the experience.

## **During Data Collection**

During data collection refers to the period in which participants are actually interacting with each other and the room. Throughout this period, researchers should monitor individuals while in the escape room to ensure that the activity is running correctly, potentially provide hints to participant teams that are struggling, and reset the room between participant trials.

### *Consideration 5. Monitoring Individuals*

Once data collection has launched, it becomes necessary to monitor and guide all of the respective individuals involved – researchers, observers, confederates, and participants. Researchers who are less familiar with escape room research may need instructions or reminders to not interfere with the participants' progress and should not offer unsolicited hints or advice. Embedded research team members may need guidance with ensuring that they stay on script and to provide hints that are established a priori. Ensuring that researchers and confederates do not interfere or deviate from established plans fosters the ability to make comparisons between groups that complete the escape room. Introducing novel behaviors (e.g., researchers interfering or confederates going off-script) could artificially alter the findings and taint the potential conclusions.

In addition to the aforementioned individuals, participants will likely need careful monitoring and guidance while they are navigating the escape room. Participants should be monitored to mitigate cheating, facilitate time management, and assess their progress. As participants navigate the room, it is possible that some of them might be tempted to cheat. Cheating may take many forms but some common ways may include using physical force to skip a puzzle, bypassing puzzles by using an algorithm instead of solving the puzzles as intended, or using resources beyond the constraints of the escape room to solve puzzles such as obtaining advanced knowledge of the room or using cell phones or other external resources to aid puzzle completion. Considering that cheating could confound other targeted variables during collection (e.g., time to unlock a puzzle), researchers should scrutinize participants' actions to deter cheating behaviors. Participants might also need assistance with managing their time. Many rooms are bounded by time limits, and it is possible that participants may be so engrossed in the room that they are unaware of the time. Finally, simply just examining participants' progress of maneuvering throughout the room is beneficial since it is possible that they could get stuck on a particular object or puzzle, materials within the room may break, and arguably more important the win-loss condition may need scrutiny depending upon the specifics of the win/loss condition.



### ***Consideration 6. Providing Hints***

Some groups in the escape room may reach a state of impasse where they cannot proceed. Most escape rooms provide the opportunity for their participants to obtain hints to overcome obstacles in the escape room. For example, participants stuck on a number lock that is solved by a counting puzzles might receive a hint to recount a specific item within the puzzle in order to get the correct answer.

Many escape room experiences provide participants with a limited number of hints while others are unlimited, constrained by the judgment of the researcher. Implementations of these hints may take multiple forms that include user-requested help (user pull), game manager offered support (manager push), or time-sequenced aid (automatic). User-requested help involves participants asking for help when they desire aid, and a common implementation is to have all participants agree that a hint is being requested before one is provided to promote unity and team progression in the room. Researcher offered support may include hints being offered to participants freely when researchers observe that participants are no longer making progress. Time-based aid can involve hints being provided at specific times during the escape room event, regardless of the current state of progress in that room. Whichever method is used these hints can be provided by various methods such as via loudspeaker to participants in the room, delivered by cell phones or other screens, or through a confederate with knowledge of allowable aid for participants.

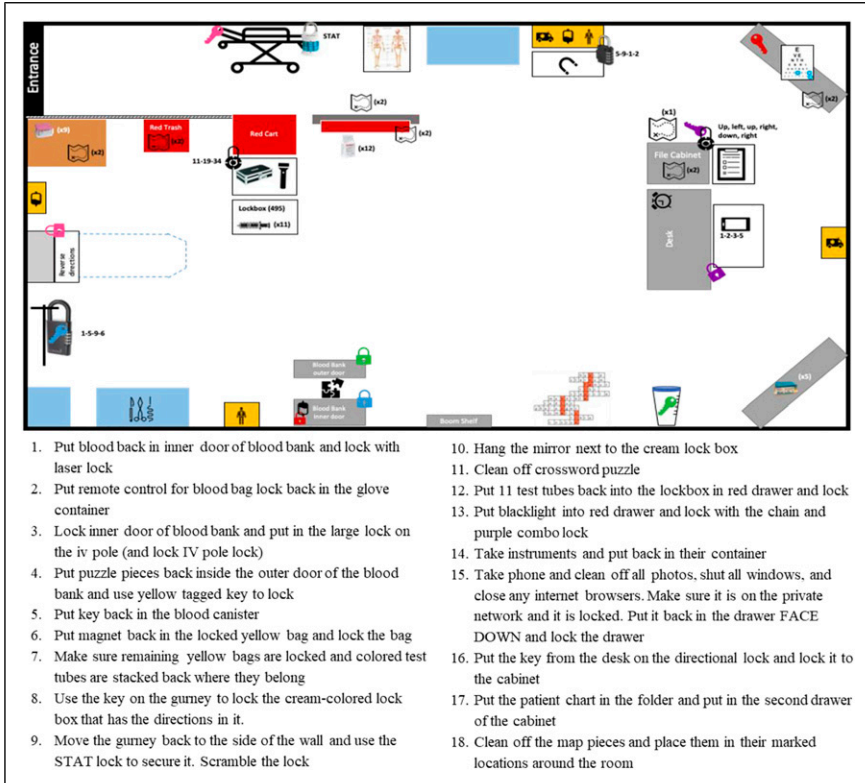
Regardless of method of hint implementation, details of the hints need to be consistently followed and allow for progression to be made without providing too much of a solution. The specific hints provided should be based on a priori operationalized guidance to participants based on their current state of progress. This structured help can maintain consistency of participant experience across repetitions of escape room delivery and help reduce variance in performance across groups.

### **After Data Collection**

Once participants have left the room and data collection has concluded, it is important to assess the integrity of collected data, to carefully consider what approach(es) are appropriate for data analysis, and to use collected data to iteratively improve the activity and its puzzles.

### ***Consideration 7. Resetting and Maintaining the Room***

Once participants complete their experience, researchers should ensure that all materials are recovered before the reset begins; this includes costume and ID number return and a check to ensure all items remain in the room. Then, the escape room must be restored to its original state to prepare for the next set of participants. A reset map may be useful to efficiently conduct restoration ([Figure 1](#)). A reset map is a pictorial representation of the escape room in its original state. It displays the location of all



**Figure 1.** Example of escape room reset map with instructions.

puzzles, locks, keys, and props, and serves as a visual aid during reset. Locks and their corresponding keys can be linked via color to enhance efficiency in resetting the room. If codes or combinations are used, they should be clearly marked on the diagram next to the locks. Diagrams can be printed and laminated so that they can be marked up during reset to ensure that all items are accounted for prior to the next session beginning. It can be augmented with instructions to ensure that those responsible for resetting the room complete the reset in the correct order.

During room reset, the escape room, puzzles, and props should be relocated to their original locations, examined for damage and degradation, and cleaned or repaired prior to the next session. Puzzles that are easily damaged (e.g., cardboard puzzle pieces) may need to be routinely replaced. Technology used in the room (e.g., cell phones, flashlights, or blacklights) should be evaluated to ensure they are charged and functioning. Surfaces that may have been written on should be cleaned (e.g., white boards) and other items should be examined for damage (e.g., cardboard puzzle pieces, items secured with zip ties) and replaced or repaired, if necessary.

### *Consideration 8. Check the Integrity of Data*

Once data collection has concluded, the integrity of all collected data should be evaluated before beginning any analyses. First, researchers should ensure that any equipment used to perform observations of participants like cameras or microphones were set up to capture participants' behaviors exhaustively during the activity. Taking such steps to ensure that background noise was minimized or that participants remain visible for the duration of video recordings will improve the quality of behavioral data analysis. In other words, the quality of collected data as issues resulting from data that is illegible, intelligible, or from equipment that was configured incorrectly will adversely impact conclusions that can be drawn from participants' time in an escape room. Simply put, you cannot analyze what you cannot observe; corrupted, unreadable, or otherwise inaccessible audiovisual data accordingly makes for a worst-case scenario in which no data can be used at all. Poor video quality can also lead to difficulties in identifying which escape room participants are engaging in specific behaviors or who is contributing to task completion. Similarly, poor audio quality can exacerbate these issues by causing difficulty in determining who is speaking at any given time which can make the attribution of behaviors to specific participants challenging. Second, researchers should also consider how participants' responses before and after the activity will be linked or how survey responses will be matched to observed behaviors (i.e., the use of subject identifiers). Next, the use of consistent participant identifiers is also important as an inadequate system for tracking participants can prevent game developers from linking participant data across time or matching survey responses with observed behaviors. Third, the reliability of survey-based measures as well as the inter-rater reliability of behavioral measures should also be assessed before beginning data analysis to ensure that participants' responses were collected, or behaviors were observed, in a consistent fashion. The use of reliable measures in survey or behaviorally based methodology is critical as data collected from unreliable measures are psychometrically unsound and can lead to false or erroneous conclusions.

### *Consideration 9. Data Collection and Analysis Approaches*

Multiple sources of data can be utilized to best understand the escape room. These can range from reactions data from those participating (e.g., was the escape room fun?) to temporal measurements (e.g., how long did it take to solve particular puzzles?). Reactionary data can inform how engaging or motivating the room was to participants. Meanwhile, temporal measurements can inform how long particular puzzles will take as well as provide insights into the time to complete the entire room. In addition to a temporal measurement, puzzle length can also be utilized as an index of difficulty. Although it does not capture difficulty in its entirety, it does indicate whether the amount of puzzle being used fits the expectation of the escape room's time limit. This data can also be utilized to understand which puzzles are fun for the participants to ensure the room is engaging.

Regarding analyses, there are a variety of approaches depending on the research questions being asked. In general, pre-post designs seem to be a high utility way to study escape rooms (e.g., Eukel et al.2017; Moore & Campbell, 2021); therefore, repeated measures quantitative methods (e.g., within-subjects ANOVA; Frenzel et al., 2020) could be useful in seeing changes in the individuals/teams. Modern teamwork research also relies heavily on *mixed-models*, which are linear models with multiple levels allowing for estimation of individual-level factors within team-level factors (Todd et al, 2005). There are also *latent-growth curve models* that allow for the assessment of the effects of time on other variables (e.g., Cai, 2013; Pai et al., 2020). For more details on analytical techniques, please see (Byrne, 2016). One of the major considerations for determining which technique to employ is sample size. Consequently, researchers should rely heavily on power analyses to understand the constraints of their study regarding sample sizes and error rates. For example, a study attempting to detect change in a few variables from one time to another may only require 30 to 50 participants, whereas a larger linear model may need hundreds of participants.

### *Consideration 10. Reviewing and Revising the Escape Room*

Consistent review of the escape room design based on the data collected during escape room performance helps ensure the best platform for research and data collection. While the escape room should not be modified in the middle of research, lessons may be learned by examining performance to improve further iterations afterward.

These lessons from the data can help inform modifications to the level of difficulty of the escape room. If almost no participants are solving the escape room, modifications to difficulty or improvements to hints may be needed. If participants are getting stuck on only one puzzle while the remaining are balanced correctly, the data can help identify that one source as a problem and be updated accordingly. If the majority of participants are achieving success in the room without using any hints, it may suggest the level of challenge in the puzzles might need to be raised. If the average rate of completion of the room by all participants is faster than intended, perhaps additional challenges, more difficult puzzles, less time, or greater task interdependence could be added to the experience to achieve the desired outcome.

While details of the puzzles and hints are important, other details may also benefit from review, such as identification of displaced physical artifacts by participants that need to be anchored or may have been omitted from the reset map. Analysis of communication amongst participants can help identify issues with task interdependence that may be missing. Debriefing data collected at the end of the research experience can help inform suggestions for adjustments based on participant satisfaction or enjoyment or other factors that may not be as obvious within objective data. Finally, a review of the escape room may also provide indications of when the room should be retired due to lack of interest or no longer effective data being collected.

## Conclusion

Escape rooms are an increasingly popular avenue for recreation as well as research; however, guidance for conducting escape rooms is sparse. To fill this gap, we have provided multiple considerations related to conducting an escape room before, during, and after data collection.

Since the literature concerning escape rooms is still in its infancy, these considerations are largely rooted in our expertise in research and experiences using escape rooms in applied contexts. Moving forward, escape rooms hold promise as a dynamic and exciting avenue for teams interventions and applied research alike. More guidance would certainly be welcomed in the literature concerning other facets of conducting an escape room, designing puzzles, or adapting escape rooms for remote or virtual modalities. Still, the considerations provided in this article can support organizations interested in unlocking the full potential of escape rooms.

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