

# Mars Habitat Formative Evaluation Report

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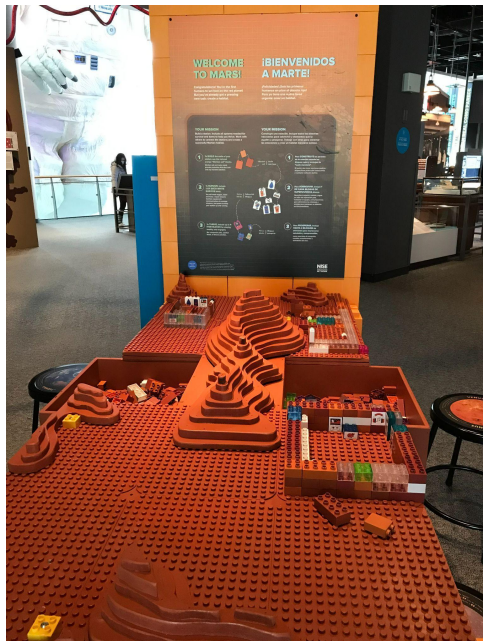
Data collection for the Mars Habitat formative evaluation occurred in three rounds. Data was analyzed after each round to allow for changes and updates to the Mars Exhibit as needed. This report begins with an executive summary and overview of the results across all three rounds, and then provides the detailed results from each round.

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## Executive Summary

### Background and overview

Build a Mars Habitat - Survive and Thrive is a three-year TEAM II project developed by The Science Museum of Minnesota (SMM) in collaboration with National Informal STEM Education Network (NISE Network). In collaboration with NASA subject matter experts and museum educators, the project team designed the exhibit content and visitor experience to inspire, engage, and educate the next generation of explorers about human exploration on Mars. The primary goal of the exhibit component is to engage audiences in authentic STEM learning related to space exploration and to foster 21st Century Skills such as creativity, problem-solving, and collaboration. Specifically, the exhibit component materials and content are designed to engage audiences in space exploration by providing an interactive to explore the possibility of building and living (i.e., survive and thrive) in a Mars Habitat.



The prototype exhibit component is a table that seats four individuals, and includes a set of LEGO-like building construction pieces with a baseplate reminiscent of the Mars planet-scape, as well as graphic signage explaining the Mars setting and activity instructions. There are two categories of blocks: white “survive” blocks with stickers indicating universally necessary systems for survival – Water, Oxygen, Food, Power, Communication, Recycling; and multicolored “thrive” blocks with stickers of equally important human and social needs that can be satisfied in a number of ways depending on individual personalities and interests (e.g., exercise, music, pets, books, or “junk” foods.). There are also clear, brown, and red blocks representing Martian building materials that have no stickers.

## Methods

Data collection included a cued observation and follow-up interview conducted onsite. The Mars Habitat table was located on level 4 of the Science Museum of Minnesota, in the Sun Earth Universe mini exhibition. Non-school groups with at least one adult and one child 10-14 years old were recruited using an invisible line method. Every group that appeared eligible was approached.

## Sample

Data was collected from 29 groups across three rounds; 7 groups in round 1, 12 in round 2 and 10 in round 3. Between rounds, data was thematically coded and shared with the design team. Both the exhibit table and evaluation instruments were modified as necessary.

Across all three rounds, the average group size was 4 and the average dwell time was around 19 minutes. Demographic information was collected from only one adult group member; 63% of respondents indicated they were White, 30% were BIPOC and 4% preferred not to say.

## Takeaways

Changes to the activity were focused exclusively on the instruction graphics between rounds of data collection. Based on earlier proof of concept testing conducted by the exhibit design team, as well as round 1 data, it appeared that the building aspects of the table and iconography stickers on the blocks were working as intended for the target audience, so the design and evaluation teams prioritized the instruction graphic. These changes are summarized below.

- After round 1, the color-contrast was increased to improve readability.
- The number of words were decreased after both round 1 and 2 to streamline instructions and put main ideas front and center.
- After round 2, icons with brief descriptions were added to graphically clarify what the blocks represented.

## Evaluation Question 1: Do visitors feel like they know what to do?

- Interlocking building blocks are intuitive; visitors understand how to use them quickly.
  - Even without instructions, using LEGO-like blocks to build structures is instinctual, and participants understood they were supposed to build something even if they didn't know *why* they were building something. Nearly every group immediately started building when they approached the table.
- Short and sweet instructions are both a best practice as well as necessary to situate the “so what” of the activity front and center. After simplifying and clarifying graphic panels, we saw adult participation in scaffolding the activity increase along with increased attention to the instructions overall.

## Evaluation Question 2: How do visitors interact with the exhibit and each other?

*Interactions with the table and building*

- Average dwell time spent at the table started relatively high<sup>1</sup> (12 minutes in round 1) and doubled by the third round. It increased in both round 2 (18 minutes) and round 3 (25 minutes). This corresponds with adjustments to simplify and clarify the instructions, but it is unclear if the two are causally related.

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<sup>1</sup>Serrell, B. (2010). Paying attention: The duration and allocation of visitors' time in museum exhibitions. *Curator: The Museum Journal*, 40(2), 108-125. <https://doi.org/10.1111/j.2151-6952.1997.tb01292.x>

- Participants gravitated towards building habitat structures to provide shelter. Across all 3 rounds, habitat structures that included long-term living spaces were the most prominent, but there were also a handful of cases that included geological features (mountains), non-habitat structures (like greenhouses or swimming pools), and infrastructure items (such as bridges).
- While a few cases included “live-work” situations of research compounds and scientific outposts, most builders chose to focus on only the “home” or “research” aspect in their structures. This often resulted in one individual creating multiple buildings to accommodate various needs.
- Respondents’ sense that their structures were “complete” was driven by ideas and goals presented via the instructions (e.g., having all the things needed to survive) as well as their own goals (e.g., there were no gaps in the walls, all the pieces in the bin had been utilized).

#### *Interactions with each other*

- Adults were the primary facilitators of discussion and deeper engagement with content. As mentioned earlier, youth tended to immediately begin building, and the adult in the group was almost exclusively responsible for directing attention to the information graphic and checking in on progress with “survive and thrive” goals.
- The table provided ample opportunities for group collaboration, and participants moved in and out of different types of collaboration. While structural building was almost always independent (i.e., most youth built their own structure), there was regular discussion and interaction between group members at the table. Adults and youth were observed occasionally working together to problem-solve a specific build challenge or find needed pieces. We rarely saw youth opting to build one structure together, however some groups eventually transitioned to joining up and connecting their individual builds.
- There was a sense of building a community on Mars, evident in the constructions and discussions produced in some groups, particularly in round 3. For example, even if buildings were not physically connected, there was often table discussion of resource sharing and social visiting.
- There was variation in how the “survive” and “thrive” blocks were integrated into structures. Some were part of walls, others were the focal point of rooms, or used to represent where items would be (e.g., the exercise equipment in a gym, cat in the middle of a room). There wasn’t a clear pattern to how participants incorporated these blocks.

#### **Evaluation Question 3: Do visitors walk away with an understanding of the intended ideas?**

- While discussion of “survive and thrive” was observed in half of the groups in round 1, this increased to over half of the participating groups in rounds 2 and 3. This may be due to the simplified instructions outlining the activity goals of survive and thrive.
- When prompted, nearly every group shared that the activity was about surviving or living on Mars. However, this wasn’t always reflected in at-the-table behaviors and conversations. Those types of unprompted table-based discussions of “survive and thrive” were driven by adult facilitation.
- Responses to interview questions demonstrate there was an understanding of the concept of survive and thrive (i.e., you need things beyond water, food and air) but limited mention of the actual word thrive when responding. Often, the thrive elements were described as ways to fend off boredom and stay healthy. While participants seem to understand the concept of thrive, there may be a disconnect in fully understanding how these contribute to survival holistically.

- For example, in round 3 several interview participants described it as “needs and wants” which may have been related to the way the graphic panel has been revised to highlight the two overarching survive and thrive categories or due to participant interpretation of the activity objective.
- Adults generally seem to understand the intention behind the “survive” systems that function to produce oxygen, water, power, and food for people living on Mars, but sometimes youth missed this nuance and assumed “survive” blocks represented storage and stockpiles that needed to be brought from Earth (or delivered on an ongoing basis).
  - This might be a conflict between the understanding that Mars is isolated, far away, and you would need to be prepared with all your supplies because you are cut off from easy access, with the idea that living on Mars would require novel systems and structures to utilize the natural resources present.

## Recommendations

- *Facilitation: Adults and the research team played an important role in prompting activity understanding, and groups without adult facilitators or follow-up questions may benefit from additional support in understanding the activity goals and purpose.*
  - Across all three rounds, we saw that adults serve as primary drivers in directing group conversations about the intended learning goals and main messaging. Even in the absence of consistent adult facilitation, the interview prompts were often enough to support making connections about the activity goals and purpose. Would suggested staff facilitation questions, or scaffolding “hooks” be useful to prompt deeper understanding?
- *Understanding: There were several concepts that were interpreted differently by visitors which warrants reflection on what, if anything, requires clarification to further define the activity’s purpose and goals.*
  - **Survive and thrive:** Is it important that visitors understand survive and thrive as equally necessary for long term habitation, as opposed to tiered (the idea of wants and needs)? Instructions already require a minimum number of “thrive” pieces, but “survive” instructions include the word “necessary” while “thrive” does not. If this is an important concept for visitors to grasp, perhaps tweaking a few words on the brief description could help shift the mindset.
  - **Systems vs storage:** Is it important that groups understand that the white blocks are systems rather than storage? The current icons are easily recognizable as the resources they provide (oxygen, water, energy, food) and the instructions with added graphics further help identify them. However, by condensing the block to a single piece rather than a pair that was originally planned for the Everblocks, the “system” aspect may be getting lost. If understanding the systems (as opposed to the idea that supplies are being shipped, etc.) is important, perhaps modifying the power, water, food, and oxygen survive blocks to feature the production aspects in the icon as well as adding language to the brief description on the instructions is necessary. It is also worth considering if there is a way to prompt adults to clarify this concept for youth.
  - **Community:** Is it important if there is a sense of community on Mars among visitors? While some groups acknowledged that they would be coexisting on Mars by discussing how they would share resources, visit each other, or live in a city,

many group members built independent structures with discussion implying that they would all be living separately, in their own area and with their own resources. Additional guidance on if and how they are creating a community together (or not), may help guide collaboration among group members.

- **Design:** Across all three rounds, we saw visitors use the icons in different ways. Some visitors placed the blocks within structures where they envisioned the icon would be realistically, (i.e., couch facing a tv) while some built the icon blocks directly into the structure, lined them up along the walls of the structure or added them to the exterior. While the red blocks are identified for building in the instructions, additional information on how the icon blocks should be integrated may be helpful, if this is an important concept for visitors to understand.

# Round 1: Detailed Results

Collection period: November 19, 2021 - November 28, 2021

7 groups

## Who participated?

The first round of data collection observed and interviewed 7 groups.

- Average group size: 3
- Average time at the table: 12 minutes

Group sizes ranged from 2 to 4, and time at the table ranged between 7 and 19 minutes. Only 1 group built structures that were physically connected. There was 1 group which included a member with a temporary or permanent disability.

## Do visitors feel like they know what to do when they approach the table?

- The LEGOS (building blocks) are fairly straightforward. Several groups (4) shared that they saw the blocks and felt they knew what to do immediately.
- Despite the understanding of blocks, 4 groups shared that the instructions provided clarity on the activity and helped guide their experience.
- The majority of groups (5) were observed to read the instructions. Of those groups, 2 immediately began building structures and later referred to the instructions.
- Related to this, one group was observed to identify the purpose of the yellow blocks.

**Takeaway:** The blocks are intuitive. People just start building and they assume they know the objective; instructions may be a second thought until they run into a problem, are curious about the pictures or are prompted by another group member.

## How do the visitors interact with the exhibit and each other?

- On average, groups built 3 structures with a range from 1 - 5.
- Across 7 groups, 19 buildings were constructed.
  - 10 built by 1 child only
  - 5 built by 1 adult only
  - 3 built by 1 adult and 1 child together
  - 1 built by 2 children

## What did they build and why?

- Most groups (5) shared that they built a home or “home-base” type of structure. Of these groups, 3 explained it was necessary for survival and protection on Mars.
- Several groups (3) built structures with food considerations in mind specifically, i.e., a greenhouse.
- There were also groups (2) that built individual items (i.e., stairs, a wall) as opposed to a cohesive structure.

- It does not appear that visitors treat the 3-D connector blocks differently than any of the other brown/red building blocks –they incorporated them into the structure, but they do not seem to serve a specific “linking” purpose for connecting structures for a habitat.

**Takeaway:** Groups are building multiple habitation/habitation-related structures that incorporate survival and thriving elements, but most are not connecting them into a single unit that would maintain an atmosphere. While oxygen is recognized as a survival need, groups do not appear to tackle the challenge of conserving it via building design.

#### **How did they decide it was complete?**

- A few (2) groups shared their structures were complete when they had everything they needed, and 2 groups explained their building was complete because it met certain physical criteria.
- There were also 2 groups who did not provide a clear reason beyond ‘a feeling’, and 2 who shared they were not quite finished building despite being ready to move on from the exhibit table.

**Takeaway:** There isn’t a clear pattern to how visitors feel their building is complete.

#### **How did visitors interact with each other?**

- Children were observed as both independent builders (4 groups), but adults also worked collaboratively with children in 3 groups; finding pieces, reading the instructions and making decisions about what to include. There was 1 group in which the children collaborated with each other, exchanging pieces and building together.

**Takeaway:** There are various types of collaboration occurring organically, with adults supporting youth both passively (handing them blocks) and actively (discussing the activity and building together).

#### **Do visitors walk away with an understanding of the intended ideas?**

- 3 groups actively discussed the materials they’d need to survive and thrive (water, food, pets, etc.) on Mars while building.
- When asked what they would need to survive on Mars, all groups shared essential items such as water, oxygen, etc.
- The majority of groups (6/7) also shared they would need additional items to thrive, such as books, animals and stuff to interact with even if they didn’t explicitly include those items in their buildings.

**Takeaway:** There was a definite interest in the “thrive” non-essential blocks, with many groups commenting on the pictures and making an effort to include these items in their structure.

#### **Next steps**

- **Takeaway:** The blocks are intuitive and attractive. People just start building; instructions may be a second thought until they run into a problem or are prompted by another group member. As a result, it appeared groups believed they knew *what* to do when sitting down, even if they didn’t understand the *why* intended by exhibit developers. Even if they consulted instructions, many groups did not do the challenge.

- **Recommendation:** Visitors may benefit from the instructions being integrated into the table where they can interact with the blocks and instructions at the same time. The evaluation instrument will also be adjusted. Rather than asking visitors if they knew *what* to do, ask visitors if they understood *why* (i.e., learning goals/outcomes).
- **Takeaway:** Even when consulting the instructions, visitors appear to be motivated by a desire to build with the blocks versus a desire to complete the challenge activity. This may reflect the known challenges of the directions (i.e., too much text and color contrast issues).
  - **Recommendation:** The design team has already planned to adjust both of these items, which may lead to an increased interest in reading and following the instructions. The instrument will also be adjusted to note when visitors consulted the instructions during their time at the table.
- **Takeaway:** There isn't a clear pattern to how visitors feel their building is complete.
  - **Recommendation:** This may resolve itself with changes to the instructions presentation. Modified follow-up interview questions may also help us better understand how visitors perceive the activity goals. Additional instructions on building design may also be helpful if this is seen as a core part of the experience.

### Demographic Summary

- Race/ethnicity<sup>2</sup>
  - American Indian or Alaskan Native: 0
  - Asian or Asian American: 1
  - Black or African American: 0
  - Hispanic or Latino/a/x: 0
  - Native Hawaiian or Pacific Islander: 0
  - White: 5
  - Checked multiple boxes: 1
- Ages of participants
  - Adults: 11
  - Youth (ages 9 & under): 3
  - Youth (ages 10 - 14): 8
  - Youth (ages 15+): 1

**Total participants in Round 1: 23**

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<sup>2</sup> Race/ethnicity reflects only the individual who filled out the survey, not necessarily the whole group.



## Round 2: Detailed Results

Collection period: December 9, 2021 - December 19, 2021

12 groups

### What changed?

After the first round, updates were made both to the Mars Habitat table as well as the evaluation instrument. At the table, the graphic was updated to a shorter version in a more readable color.

The **observation protocol** was updated to improve how we were looking for understanding. The observation prompts were modified to note when the visitors consulted the instructions (not just if they did) as well as to note if and how they discussed “survive and thrive” during their time at the table. Additional detail was also added to help observers note if and how buildings were connected, if at all.

The **interview instrument** was also modified slightly. Additional probing questions were added to explore what is contributing to participant feelings of “done” for building - specifically exploring if they had a goal in mind and where that goal came from. The question about what kinds of things you would need to survive and thrive on Mars was also changed to a more knowledge-based question, (i.e., What types of things would humans need to think about or do to survive and thrive on Mars?). Finally, the question about first impressions was changed to “What do you think this activity was about?” with a prompt to follow up about what the activity was trying to get people to understand.

With these changes, we are hopeful that round 2 provides insight into how visitors approach the table, how visitors are using the table, and if/how visitors understand the activity goals.

In regards to our sample, we had about double the number of participants (23 in round 1 compared to 49 in round 2) and 5 more participating groups in round 2 (12 compared to 7 in round 1).

### Who participated?

The second round of data collection observed and interviewed 12 groups.

- Average group size: 4
- Average time at the table: 18 minutes

Group sizes ranged from 2 to 6, and time at the table ranged from 6 to 44 minutes.

### Do visitors feel like they know what to do when they approach the table?

- The majority of groups (10) were observed to read the instructions.
- Of the 10 groups who read the instructions, 8 groups were adult-facilitated (adults reading instructions to youth). All 8 of these groups were observed to understand the goals of the

activity (survive and thrive) and observed to have more discussion than non-adult facilitated groups.

**Takeaway:** It appears many of the same things remained true for this round (the LEGOS are intuitive, etc.), but the majority of groups this round appear to be engaging with the instructions more consistently. Adult facilitators appeared to drive discussion around survive and thrive elements as well as the activity goals.

### How do the visitors interact with the exhibit and each other?

- On average, groups built 3 structures
- Across 12 groups, 37 buildings were constructed.

### What did they build and why?

- Nearly all (11) groups built some sort of living structure with the majority (10) sharing that at least one group member built a house. Of these, 6 shared that this was necessary for shelter while four groups did not provide a specific reason.
- 3 respondents specifically shared a reason related to “thriving” on Mars, demonstrating an understanding of the activity goal.
- There were also 5 groups that built individual items (such as a tunnel, bridge) as opposed to a cohesive structure.
- A few (2) groups built space (greenhouse or unnamed space) with a specific mention that they were necessary to grow food.
- Only one group built structures that were physically connected, and two groups built structures that were not physically connected, but related (i.e., a house and an associated greenhouse).

**Takeaway:** Participants naturally gravitate towards building a home or living structure even without consulting the instructions or other groups members. Building strategies remained largely unchanged through round 1. Similar to round 1, while survival elements are included in the structure, there does not appear to be consideration of oxygen conservation via building design.

### How did they decide it was complete?

- Most groups (9) shared that their structure was complete when they achieved a specific goal with goals ranging from having all the essentials to completing a specific element that they found necessary.
- A few groups (3) also shared that they didn’t complete the building, with one child mentioning that they would have continued except their group was ready to leave.
- There were also 3 groups with respondents who shared that they deemed the structure complete because they didn’t know how to continue.

**Takeaway:** The understanding of an end goal appears more prominently in these results compared to round 1 but this is likely a result of the instrument change. When prompted about what the building goal was, responses revealed an understanding of the activity goals (needed specific items, needed a specific element).

### How did visitors interact with each other?

- Out of the 12 observed groups, 8 collaborated in multiple ways throughout the duration of their time at the table.
- Overall, in the majority of groups (8) adults facilitated at least some part of the activity ranging from active help to instructing other group members to reminding others of activity goals.
- Children also worked as independent builders in 5 groups, and collaborated with other children at the table in 5 groups. There were also instances (5 groups) of adults observing children quietly and not supporting.

**Takeaway:** Group members engage with other members in various ways throughout their time at the table. Adult facilitation is adult-driven (children were not observed to be asking for guidance or assistance) and was the most prominent form of collaboration observed. This is largely unchanged from round 1.

### Do visitors walk away with an understanding of the intended ideas?

- When asked what was needed to survive on Mars, the majority of groups (9) shared both survive and thrive elements, noting that they would need stuff to entertain themselves, stay active and keep themselves going, and 4 groups shared only essential survival elements.
- While building, just over half of the groups (7) actively discussed the elements required to both survive and thrive on Mars, and there was 1 group who were observed to discuss only survival elements.
- Two groups did not mention the goals or any survive and thrive elements while building at the table.
- When prompted to think about what the goal of the activity was, 9 groups shared responses related to Mars survival. No groups specifically mentioned both survive and thrive.

**Takeaway:** Most groups understood the goal of the activity, i.e., living on Mars. While no groups mentioned “thrive” when asked, the observed discussion *during* the building period demonstrates there is some understanding of this goal by participants.

### Next steps

- **Takeaway:** Of the groups who actively discussed the survive and thrive goals throughout their time at the table, they all had active adult facilitators driving conversation, reminding youth of the instructions and occasionally participating in building. In the groups with limited adult involvement, youth did not appear to engage with the instructions or consider the activity goals while building.
  - **Recommendation:** A facilitator may be a useful addition to the Mars Habitat table to help guide youth or at least bring their attention to the instructions. However, the majority of groups did have engaged adults facilitating so it may not be a fully necessary addition to the experience.

- **Takeaway:** Almost all groups were observed to read the instructions, and groups with engaged adults all read the instructions with some discussion. This is a change from round 1 of observations.
  - **Recommendation:** It appears many of the issues with the instructions observed in round 1 were resolved with the updated graphic. Additional shortening may be useful but isn't identified as necessary based on the results from round 2.

### **Demographic Summary**

- Race/ethnicity<sup>3</sup>
  - American Indian or Alaskan Native: 0
  - Asian or Asian American: 0
  - Black or African American: 0
  - Hispanic or Latino/a/x: 1
  - Native Hawaiian or Pacific Islander: 0
  - White: 6
  - Checked multiple boxes: 3
  - Prefer to self describe: 1
- Ages of participants
  - Adults: 18
  - Youth (ages 9 & under): 12
  - Youth (ages 10 - 14): 17
  - Youth (ages 15+): 2

**Total participants in Round 2: 49**

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<sup>3</sup> Race/ethnicity reflects only the individual who filled out the survey, not necessarily the whole group.

## Round 3: Detailed Results

Collection period: January 5, 2022 - January 16, 2022

10 groups

### What changed?

After the second round of data collection, updates were made to the Mars Habitat table as well as some minor updates to the evaluation instrument. At the Mars Habitat table, the instructional graphics were changed to be significantly shorter, and included large graphic depictions of the various blocks. This also included a written description of what these blocks represent.

The observation instrument was updated slightly to include observation for how visitors used the instructions, in addition to earlier changes which included noting when and if visitors consulted the directions. The interview instrument was slightly modified to include additional follow up questions around if the instructions were helpful and guided activity to explore how the new instructions impacted participants' actions at the table.

In the third round, 10 groups were observed and interviewed, representing 39 participants. This is less than round 2 (49 participants in 12 groups) but more than round 1 (23 participants in 7 groups). The results presented below are for round 3 only.

### Who participated?

The third round of data collection observed and interviewed 10 groups.

- Average group size: 4
- Average time at the table: 25 minutes

Group sizes ranged from 6 to 2, and time at the table ranged from 16 to 37 minutes. The average time at the table increased every round from 12 minutes in round 1<sup>4</sup>, to 18 in round 2, to 25 minutes in round 3. There was one group with an individual who had a disability.

### Do visitors feel like they know what to do when they approach the table?

- The majority of groups (9) were observed to read the instructions although the timing at which they read them slightly varied.
- Of the groups who read the instructions, the majority (8) were adult facilitated; an adult in the group either read the instructions out loud or directed other group members to read them.
- Several groups (4) were also observed to use the graphics on the instructions throughout and used the instructions to understand the various icons that they found on the table.

**Takeaway:** Round 3 featured simpler and more visual instructions. As with earlier rounds, the majority of groups engaged with the instructions at some point. Adult facilitators remained

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<sup>4</sup> Round 1 had a sample size of 7 groups, and round 2 had a sample size of 12 groups which may account for some of this variation.

influential in this behavior by either reading the instructions out loud to younger participants or calling attention to those instructions. The larger graphics depicting what the various blocks meant appeared to be helpful as a reference for groups throughout the activity.

### How do the visitors interact with the exhibit and each other?

- On average, groups built 3.6 structures
- Across 10 groups, 36 buildings were constructed.
- Community or idea of community in 4 groups

### What did they build and why?

- Nearly all (9) groups built some sort of living structure (i.e., a base, compound, house, etc.) Of these, 6 included at least one person who shared they built a house. The majority of groups (6) shared they built their structure for survival reasons such as shelter or implied shelter (i.e., a “need” for a house).
- Other reasons shared included abstract reasons such as “my imagination” (3), the instructions (2), external factors (movies, photos; 2) and one group mentioned thrive considerations.
- A few groups (2) shared that they built specific separate structures to meet thrive needs (a swimming pool, a gym) and 3 groups shared that they built separate structures to meet survival needs (a cell tower, a research area).
- Half of the groups built a greenhouse or a designated area to grow food, such as a garden.
- A few groups (2) built abstract items; a bridge and a mountain.
- There were 4 groups who discussed or implied a community on Mars; even when their structures were not physically connected, they discussed sharing resources and space with each other.

**Takeaway:** We continued to see many of the same trends in terms of building structures in this round; participants naturally gravitated towards building a house or living structure. This round, we saw an increased sense of community among group members, building with the idea that they would all be sharing space and resources on Mars. It’s unclear why, but this could be due to improved understanding of the activity goals or specific group characteristics. Groups who shared specific “survive and thrive” considerations in regards to why they built their structure typically had more involved adults.

### How did they decide it was complete?

- Nearly all groups (9) shared that their structure was complete when they had acquired everything they needed.
- One respondent shared that they didn’t complete their building, but still shared that it would have felt complete if they had everything they needed.
- There was also one respondent who shared that they felt it was complete because it was a square.

**Takeaway:** Nearly all groups indicated that getting everything they needed was their ultimate goal and reason for deeming the building complete. This is similar to what we saw in round 2 where this prompt was added.

#### **How did visitors interact with each other?**

- All groups collaborated in multiple ways during their time at the table.
- Overall, in the majority of groups (7) adults facilitated at least some part of the activity ranging from active help to instructing other group members to reminding others of activity goals.
- In over half the groups (6), the adults left the table at some point during the duration of the activity and did not pay attention to the Mars activity.
- Children were also observed to collaborate with other children (4) and serve as facilitators for each other.
- There was also one group in which both children built independently with little to no collaboration.
- The majority of buildings (21) were constructed by one child independently, although they may have received support from others, they built their own structure.
- A few buildings (6) were co-constructed between an adult and a child.
- Adults constructed 4 buildings without children, and 1 building was built by two children together.

**Takeaway:** Groups interact in many ways throughout their time at the table. As with previous rounds, many groups were facilitated by adult members although children were observed to support each other periodically as well. These results indicate a natural sense of group collaboration tends to appear when at the Mars table. These results align with what we saw in both rounds 1 and 2. However, despite adult facilitation, the majority of children built their own structure independently.

#### **Do visitors walk away with an understanding of the intended ideas?**

- When prompted to think about what was needed to survive on Mars, over half of the groups (6) shared both survive and thrive elements, although no groups actually used the word *thrive*. The remaining 4 groups shared only essential survival items when prompted.
- While building, over half of the groups (6) were observed to discuss survive and thrive as a concept with discussions ranging from adults explaining what “thrive” meant to highlighting the importance of the “fun stuff”.
- Across the 10 groups, 3 were not observed to mention survive and thrive during their time at the table.
- When prompted to think about what the goal of the activity was, 6 groups shared ideas related to surviving and building on Mars, and 4 groups shared responses related to both surviving and thriving on Mars.

**Takeaway:** All groups shared goals related to “living on Mars” when prompted, although not all specifically mentioned both survive and thrive goals. This is a change from earlier rounds in which visitors did not share any specific thrive goals when prompted about the activity purpose.

As seen earlier, many groups were also observed to discuss survive and thrive elements at the table throughout the building process.

### Additional considerations

While observed in only one or two cases, there were a few observations and thoughts which may warrant further discussion from the design team if they are concepts or ideas that warrant added clarification or detail to help participants meet the intended learning outcomes for the Mars table.

- There was one group questioning the role of the colored blocks that don't have icons. They wanted to include them as "thrive" elements in their structure, but were unsure if they "counted" since they didn't have the images on them indicating their purpose.
- Similarly, the clear blocks were of interest to a few groups with questions surrounding what their purpose was. Uses for the clear blocks included windows (glass), and air.
- We did not explicitly ask about this, but comments from one group during the interview indicate that the child participant did not understand the "system" nature of some of the survive blocks, i.e., that they were systems to produce oxygen, water, food, and power rather than just storage or stockpiles. However they did understand that it would take a long time for supplies to make it from Earth to Mars, they just assumed there would be regular shipments of all the supplies, so it would be important to ration.

### Big picture takeaways

- **Takeaway:** Round 3 supported much of what we had previously seen in rounds 1 and 2; adult facilitators drove discussion around survive and thrive, and were often the driver behind attention to the directions.
- **Takeaway:** The updated instructions appeared to be useful to participants to understand the different types of blocks and to remove the guessing about what the different icons represent. It appeared this helped clarify what was considered "thrive" and what was a necessity for survival.

### Demographic Summary

- Race/ethnicity<sup>5</sup>
  - American Indian or Alaskan Native: 0
  - Asian or Asian American: 0
  - Black or African American: 0
  - Hispanic or Latino/a/x: 1
  - Native Hawaiian or Pacific Islander: 0
  - White: 6
  - Checked multiple boxes: 1
  - Prefer not to say: 1
- Ages of group members
  - Adults: 15
  - Youth (ages 9 & under): 9

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<sup>5</sup> Race/ethnicity reflects only the individual who filled out the survey, not necessarily the whole group.



- Youth (ages 10 - 14): 14
- Youth (ages 15+): 0

**Total participants in Round 3: 38**