MUSEUM VISITORS' ENGAGEMENT, LEARNING, AND IDENTITY EXPLORATION AROUND INVENTIVENESS IN CHANGE YOUR GAME | CAMBIA TU JUEGO

Post-Opening Research Report

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Executive Summary

Change Your Game | Cambia tu juego (CYG) is a 3,500 square foot exhibition located in the Lemelson Hall of Invention and Innovation at the National Museum of American History in Washington, DC. The exhibition, which opened in March 2024, has dual goals: "to demonstrate how diverse inventors, athletes, and technologies have been motivated to change how we play sports throughout history, while engaging visitors to identify themselves as inventive problem solvers who can become 'game changers' in their daily lives (Lemelson Center for the Study of Invention and Innovation, n.d.). Uniquely, CYG aims to support history museum visitors to move beyond passively consuming information to make meaning about ways in which the exhibition is personally relevant and to (re)consider inventiveness within their current and future life roles. To accomplish this aim, the exhibition team applied and contextualized a complex dynamic systems framework of identity, motivation, learning, and action—the Dynamic Systems Model of Role Identity (DSMRI; Kaplan & Garner, 2017)—and a set of research-informed principles for designing contexts that promote visitors' engagement with STEM and STEM-adjacent concepts, transformative experiences where 'big ideas' help individuals to re-see phenomena in the world, and identity exploration, which involves seeking and processing information and experiences in relation to the self for self-knowledge, growth, decision making, and action. The principles are collectively referred to as the Visitor Identification and Engagement in STEM (VINES) model (Garner, Kaplan & Pugh, 2016) and provide strategies for promoting learning and identity exploration in informal educational settings.

Both the DSMRI and VINES models were centrally positioned within the intellectual merit section of the NSF AISL proposal that supported the development of CYG (Smith, et al., 2021). As specified in the proposal, expectations for visitors' engagement in inventive identity processes in CYG were framed by theoretical and practical assumptions about experiences in a relatively brief visit to a museum exhibition. The proposal stated: "Given the DSMRI's nondeterministic, dynamic approach to conceptualizing inventive identity development as a feature of one or more role identities possessed by the visitor, we expect that the impacts of the exhibition experience on new identity activation and exploration will likely be varied and dependent upon where visitors are in their self-perceptions of inventiveness when they enter the exhibition. We do not expect global changes in identity after a single exhibition visit, but rather incremental shifts in self-conceptualizations about one's own capacity and agency. We posit that

the manifestations of such shifts are likely to be found in behaviors and statements that evince re framing towards self-relevance, re-seeing content in ways that recognize sport as being intimately linked to processes of invention and innovation, and re-enacting or re-imagining oneself as an inventor or innovator. Verbal impact indicators may be self- or "I" focused on one's purpose and goals, one's beliefs, and perceived possibilities for action both within the visitor role as well as other role identities" (Smith, et al. 2021, p. 8).

Our findings respond to two research questions included in the proposal: RQ1. What theoretical model of inventive identity can we formulate from an analysis of inventive identity indicators and their shifts among diverse visitors? RQ2. What can we conclude about exhibition design principles that the field can use to promote inventive and other STEM identity exploration and change among diverse groups of visitors? Moreover, the research-based nature of CYG extends existing museum visitor research on identity work (e.g., Rounds, 2006) by intentionally designing for and supporting exploration of the concept of an inventive self, and by using the same theoretical framework in both exhibition design and research on visitors' experiences. Specifically, we sought evidence of identity exploration by capturing visitors' spontaneous and prompted reflections on inventiveness and identifying how these reflections revealed the content of and/or the type of change manifested in one or more of the following identity components: inventive self-perceptions, inventive action possibilities, inventive goals, and beliefs about the definitions and domains of inventiveness.

Our research design implemented an instrumental case study with embedded units (Stake, 1994; Yin 1989) and describes the experiences and engagement of six diverse visitors to the CYG exhibition. The data collection protocol included a semi-scripted interaction to introduce the exhibition and the concept of inventiveness in one's own life, followed by detailed notetaking and observation of each visitor's experiences and engagement in the exhibition, and a stimulated recall interview following the visit. This flexible, semi-structured protocol allowed us to glean information about the ways in which unique visitors' free-choice engagement with the exhibition content manifested in the psychological process of meaning making around invention and inventive identity and is consistent with other research studies that have investigated museum visitors' meaning making (e.g. Smith, 2021). Data consisted of transcribed observation notes and statements made by the visitors throughout their visit. Data were coded by the authors using established, DSMRI-informed protocols (Kaplan & Garner, 2022) and this report includes

summaries of each individual case as well as a cross-case analysis to establish themes. Examples from the analytical process are appended.

Key findings are:

(1) *All visitors constructed personal relevance with the exhibition's content.* All the visitors made personal meaning of content in the CYG exhibition in relation to their own life. As anticipated and explicated in the proposal, this personal relevance construction varied among the visitors in the exhibition's narrative and STEM-related content and themes, the location in the exhibition where it occurred, its spontaneity, the personal domain and life roles that were considered to be relevant, the application of STEM and innovation ecosystem-adjacent ideas, and in its emotional valence. Existing identity-related experiences such as enduring interests, occupational domains, and past and future attempts at inventive problem solving were evoked by visitors as they connected the exhibition content to their own lives.

(2) *Visitors' engagement was associated with shifts in conceptions of inventiveness from being technology-based, rare, and conducted by unique individuals to more diverse in its manifestation, as including small everyday events, and as being performed by regular people.* These findings point to the exhibition's capacity to promote visitors' reflections on the nature of inventiveness, and, in turn, on their inventive identity, including self-perceptions of their own inventiveness, goals and action possibilities for transferring inventive experiences in the exhibit to their roles outside of the museum, beliefs about the position of inventiveness within their own identity, and emotions associated with each of these.

(3) *Exhibition design elements such as the presentation of "big ideas," questions that used the self-as-content, and interactives that provided opportunities to practice inventive strategies, offered visitors multiple and diverse entry-points to consider the concept of inventiveness and how they enact it in their daily lives.* In addition, for visitors who needed assistance accessing content due to individual differences such as low vision or neurodivergence, the social context of the visit and others' use of the design elements to initiate and sustain conversation, were particularly important in the meaning making process. Museum visitors' role identities and engagement in learning and identity exploration manifested as a complex and not fully predictable interplay between the designed environment and their personal characteristics.

Overall, the findings suggest that CYG supported diverse visitors to construct personal relevance, learn to "re-see" inventiveness as an accessible everyday concept, consider the

implications of their inventive experiences in the exhibition to their roles outside the museum, and explore their own identity as an individual with inventive capacities in a variety of life domains. These findings provided answers to the two research questions:

RQ1. What theoretical model of inventive identity can we formulate from an analysis of inventive identity indicators and their shifts among diverse visitors?

The DSMRI provided a theoretically robust, complex, and dynamic framework to conceptualize inventive identity as a network of invention-related beliefs, goals, self-perceptions, and perceived action possibilities that manifests within a person's role identity in their lived context (e.g., athlete, parent, student, engineer, citizen). Correspondingly, inventive identity formation involves change to the network's elements and their relations to varying degrees within and across role identities in diverse individuals' identity systems.

RQ2. What can we conclude about exhibition design principles that the field can use to promote inventive and other STEM identity exploration and change among diverse groups of visitors?"

The VINES framework provided a comprehensive set of design principles for the effective operationalization of features in very different types of exhibits (e.g., personal inventor stories, artifacts, interactives) that, across multiple exposures and variable contents and exhibit types, promoted diverse visitors' inventive identity exploration. The VINES framework of design principles were successfully transferred to a national museum context.

Museum Visitors' Engagement, Learning, and Identity Exploration Around Inventiveness in *Change Your Game | Cambia Tu juego*

Introduction

Change Your Game | Cambia Tu juego (CYG) is a 3,500 square foot exhibition located in the Lemelson Hall of Invention and Innovation at the National Museum of American History in Washington, DC. The exhibition, which opened in March 2024, has dual goals: "to demonstrate how diverse inventors, athletes, and technologies have been motivated to change how we play sports throughout history, while engaging visitors to identify themselves as inventive problem solvers who can become 'game changers' in their daily lives" (Lemelson Center for the Study of Invention and Innovation, n.d.). In service of this innovative scope, the multidisciplinary exhibition team of curators, designers, and researchers intentionally considered theoretical conceptualizations of visitor identity and exhibition design elements that would engage the public in identity exploration. Early concept testing aligned with the organization's strategic priorities to lead the team to design with a particular focus on individuals whose demographic characteristics are historically underrepresented in the American innovation ecosystem, including African American youth, adolescent girls, and individuals with disabilities (Bell et al. 2017).

The design elements included conceptually and physically organizing the exhibit around big ideas of prevalent motivations for inventing in sports such as gaining a competitive edge and improving athletes' safety. These big ideas, which are manifest in four "Motivation Zones," were linked with stories of diverse inventors, called "Very Inventive Persons" (VIPs), stories of inventive artifacts, and game-like interactives within which were embedded specific inventive strategies so that visitors could apply them and consider how they are or may be used in everyday life. Design elements also included statements and questions throughout the exhibition's text labels, interactives, and multimedia assets to affirm and promote visitors' consideration of their own inventiveness in everyday life roles.

The design principles targeted visitor learning and identity development by supporting visitors' construction of personal relevance of the exhibition's content, seeing the world (including sports and invention) through the lens of the big ideas, and exploring their own inventiveness in various life roles. The combination of these elements and principles draws from prior research on visitor learning and engagement in informal STEM learning settings (VINES;

Garner, Carver, Page & Inwood, 2019; Garner, Kaplan & Pugh, 2016), the effective use of explicit prompts to support visitors' meaning making around scientific ideas (Carver, Garner, Kaplan & Pugh, 2021), and lifespan approaches to identity development and change (Flum & Kaplan, 2006; Kaplan, Bridgelal & Garner, 2020; Kaplan & Garner, 2017; Kaplan, Sinai & Flum, 2014).

The purpose of the exhibition's post-opening research was *to examine diverse visitor responses to the exhibition's invitations to engage with and transfer applied STEM and innovation ecosystem concepts (such as technological innovation in sports), and to consider how the visitor already is and can be inventive both in sports and in other life domains and roles.* This purpose is aligned with two research questions defining the intellectual merit of the National Science Foundation AISL award that supported exhibition development and evaluation: RQ1. What theoretical model of inventive identity can we formulate from an analysis of inventive identity indicators and their shifts among diverse visitors? RQ2. What can we conclude about exhibition design principles that the field can use to promote inventive and other STEM identity exploration and change among diverse groups of visitors?

Our report presents an in-depth analysis of qualitative data (visitors' verbalizations, behavioral observations, and an "inventive me" self-report item) gathered during and immediately after walk-along visits. It identifies the ways in which the exhibition provided a context for supporting learning and identity exploration around inventiveness, as well as how specific elements in the exhibition scaffolded these processes among diverse visitors, and the different ways that the visitors manifested identity exploration. It identifies ways in which *Change Your Game | Cambia tu juego* can act as an exemplar for exhibition design that aims to support learning and identity exploration among diverse visitors, while acknowledging limitations that can be addressed in future iterations of this novel approach to exhibition design. The findings should be considered alongside the summative evaluation report by Kera Collective (2024), which summarizes n=100 face-to-face interviews of NMAH visitors who had and who had not visited CYG and presents themes derived from focus groups and structured interviews with n=58 exhibition visitors, including those representing the exhibition's target audiences of African American youth, adolescent girls, and individuals with disabilities.

A theoretical framework for inventive identity based on the Dynamic Systems Model of Role Identity

Change Your Game | Cambia tu juego is a museum exhibition that presents its content in ways that invite the visitor to see themselves as an inventive person by triggering reflection on inventive experiences in various life domains. The exhibition acts as a context for situated engagement in ideas around inventiveness, but also for evoking memories of past instances of inventiveness and imagining future ones in various non-visitor life roles. The exhibition design embraces the premise that there are many pathways to creating strong inventive self-perceptions and forming and manifesting an inventive identity. The exhibition and its associated research on visitors' experiences applies a theoretical framework that views visitors' meaning making and identity exploration around inventiveness as both the precursors and the products of acting within different social roles. The Dynamic Systems Model of Role Identity (DSMRI; Kaplan & Garner, 2017) conceptualizes an individual's meaning making and actions as arising from their situated role identity – a personal construction of who one is in the social-cultural role that the individual occupies in a particular situation, such as a student in a classroom situation, an employee in a work situation, a guest in a restaurant outing, or a visitor during a museum visit.

The DSMRI notes the shared cultural aspects of people's role identities when they occupy the same role in a situation, for example, the shared understanding by museum visitors of the purpose of a museum exhibit and the norms of behaving as a museum visitor. However, the DSMRI highlights the additional unique interpretation by each person of the role as they enact it. Thus, in the current case of *Change Your Game | Cambia tu juego*, the social context makes the role of museum visitor salient to all visitors. However, each person will construct a unique interpretation of who they are as a visitor; and, furthermore, depending on the person, their identity system during the visit may also include other salient role identities, such as parent, student, or professional. The DSMRI suggests that this situated personal interpretation of who one is in that situation—the visitor role identity and other role identities that are salient to the person—continuously emerges to both frame and be shaped by the visitor's experiences and actions.

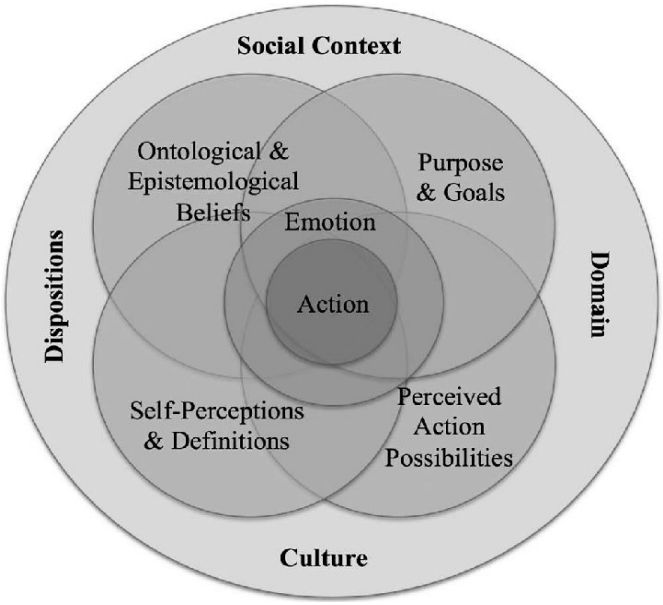

Figure 1. The Dynamic Systems Model of Role Identity (Kaplan & Garner, 2017).

Figure 1 presents a schematic of the DSMRI. The DSMRI describes the role identity that frames experiences and actions as comprising four interrelated components, including the person's (1) beliefs about the contextually situated reality of their role, what in the DSMRI is called Ontological and Epistemological beliefs, (2) purpose and goals in the role, (3) self-perceptions and self-definitions salient in the role, and (4) perceived action possibilities in the contextually situated role. These components interrelate and influence each other: the person's actions reflect their perceptions of the action possibilities that are available for them to pursue their purpose and goals, in light of their interpretation of the contextually situated reality and of themselves in it. In turn, taking an action, and the action's consequences, feed back into the person's beliefs about their role in its particular situation, perceptions of themselves, the adequacy and achievability of their purpose and goals, and the action possibilities that are available for them. Thus, the four components interact dynamically, with emotions arising from their interplay, framing, and being influenced by the actions taken in the situation. And, importantly, the emergence of these four components and their interplay is contextualized by four control parameters: the cultural meanings in the context, the social context that involves the person's social positioning and nature of social interactions they have, the role's domain of activity (e.g., home, work, museum; natural science, history, art), and the person's physical

capacities and enduring dispositions (e.g. physical disabilities, temperament, Openness to Experience, neurodivergence).

In *Change Your Game | Cambia tu juego*, the exhibition aims to elicit visitors' exploration of inventive characteristics within their role identities that could orient them towards being more inventive; in other words, strengthening their inventive identity. These inventive characteristics manifest within each of the role identity components and their relations, including, for instance, beliefs about the nature of inventiveness and of the world as having issues that require innovative problem-solving; self-perceptions as interested and capable in innovative problem-solving; purpose and goals that align with motivations to invent solutions in order to improve one's own and others' lives; and perceiving a variety of inventive strategies as action possibilities to enact in different life roles. Thus, based on the DSMRI, inventive identity refers to the person's network of inventive beliefs, goals, self-perceptions, perceived action possibilities, and related emotion that are integrated into and activated when the person occupies different social roles in their daily life. The richness, alignment, and interplay among these inventive identity components within numerous life domains and roles can foster a more robust sense of inventive identity, giving rise to emotions and actions that include attending to issues requiring solutions in one's environment, forming inventive goals, having values and self-confidence to pursue such inventive goals, and enacting inventive strategies. Pre-opening research on diverse audiences' identity exploration around the topic of invention is described in an earlier technical report and in Kaplan, Garner, Smith, & Rush (2023).

Identity exploration in museum visitor and non-visitor roles

To promote desirable shifts in visitors' inventive identity, the *Change Your Game | Cambia tu juego* exhibition features several interactive activities that invite visitors to practice inventive skills and reflect on their application to daily life. A museum visitor who enjoys inventing in exhibit interactives may experience enhanced inventive characteristics in their visitor role identity—they may approach other interactives with inventive beliefs, goals, self-perceptions, and action possibilities. However, such an identity change might be confined to the visitor role identity. It may be that the person would not consider their inventive experience in the museum to be relevant to any other role in their life. Hence, since individuals' identity systems include a network of role identities, making other role identities salient and supporting the conscious exploration and consideration of the relevance of inventive experiences in the

museum to those other role identities, can promote change in visitors meaning making and inventive identity elements and their relations across roles and contexts.

In *Change Your Game | Cambia tu juego*, the exhibition design aims to evoke a self-reflective, agentic process of identity exploration, in which the visitor is cued through label text, printed questions, and interactives to generate personal relevance of the content to other life roles and domains, and to seek and process the content and experiences as to their meaning for the self in those other roles, and in general in order to promote self-understanding, personal growth, and identity change (Flum & Kaplan, 2006; Kaplan, Garner, Rush & Smith 2023). Using the innovative concept of self-as-content (Garner, et al. 2016), *Change Your Game | Cambia tu juego* moves beyond learning about others' inventions and inventive motivations to prompt the visitor to consider their own invention-related identity components, such as their inventive self-perceptions, purposes and goals, ontological and epistemological beliefs, and action possibilities, in non-visitor roles that the visitor finds relevant and meaningful (Figure 2).

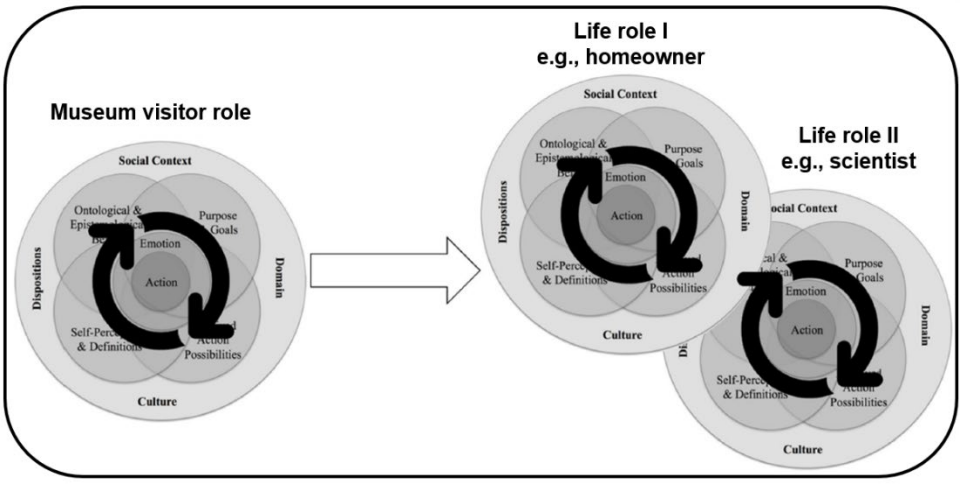

Figure 2. Change Your Game | Cambia tu juego supports the transfer of inventive self-perceptions, purposes and goals, ontological beliefs, and action possibilities from the museum visitor role to other life roles.

Exhibition design elements and principles that support identity exploration

The design of *Change Your Game | Cambia tu juego* followed design principles based on theory and research on characteristics of contexts that promote transformational learning and identity exploration (VINES; Garner et al., 2016; Kaplan et al., 2014). The principles for

promoting learning and identity exploration around inventiveness include presenting the exhibition content in a way that encourages diverse visitors to connect personal experiences from their lives with the content, thus constructing self-relevance. For example, in CYG, the content includes inventions that span advanced technologies (e.g. high-speed photo finish cameras) as well as everyday materials (e.g. the sports bra), in a large array of professional and day-to-day athletic activities, and inventors of different ethnicities, genders, abilities, disabilities, and ages, through human-interest stories that can resonate with diverse visitors. The content also includes examples of STEM adjacent concepts that are highly relevant to being successful with invention and innovation in daily life, such as solving a problem by using an existing item or concept in a new way, drafting a solution to share with others, and testing and tweaking in order to improve the success of a solution.

An additional principle is building on this self-relevance to prompt experiences of difference from the person's habitual museum visitor role identity (e.g., being a passive recipient of information), and from habitual beliefs, self-perceptions, goals, and action possibilities in relation to inventiveness and to being inventive. An effective principle for pursuing such prompting of difference is through anchoring the presentation of content in "big ideas"—compelling concepts or notions that scaffold "re-seeing" a familiar domain in a new way, whether content or oneself (Garner et al., 2016; Pugh & Girod, 2007). For example, in CYG, big ideas include the notion that inventors in sports are motivated by a variety of goals that are relevant to many other life domains (e.g., health and safety, fun for everyone), the idea that even small innovations can have large impacts, that everyone can be inventive, and that there are many different strategies to be inventive that anyone can adopt. Collectively, these big ideas aim to broaden the definition of invention so that it feels accessible and attainable by anyone and everyone, including (and especially) every visitor to the exhibition.

A third important design principle applied in CYG is fostering a sense of physical and psychological safety for identity exploration (Kaplan, Sinai & Flum, 2014). Sometimes, experiencing a difference from habitual or established beliefs and self-perceptions might be uncomfortable, and visitors should feel safe to contend with such experiences. To promote a sense of psychological safety, the exhibition team intentionally selected its stories and case studies to include a diverse representation of inventors of varying race, gender, age, and (dis)ability. The team also developed prompting experiences that generate hope and

opportunities for self-growth and contribution to others.

A final design principle involves incorporating scaffolds for visitors' intra-personal and inter-personal reflections and interactions that support their attention and exploration of the meaning of experiences of difference towards their beliefs about the content, their self-perceptions, goals, and actions. Big ideas can serve both as scaffolds for thinking about the world and the self in new ways. In addition, the design of CYG includes explicit attention to strategies for engaging in inventive behavior. These strategies, as mentioned above, are many but include iterating and tweaking, using objects and materials in new ways, finding ways to communicate your ideas to others, and working on problems you are passionate about. Inventive strategies, or action possibilities, were explicitly included into the label text, interactive activities, and video captions, as prompts to encourage visitors to reflect on their own inventiveness and about being inventive with others. For example, an exhibit label describes how Paralympic athlete and inventor Mike Schultz grew up tinkering with lawn mowers, motorcycles, and other everyday items, then applied that know-how to develop his *Moto Knee* and *Versa Foot* protheses. The label then directly addresses the visitor with an analogous action possibility: 'How could you use your know-how to creatively solve a problem?' In other areas of the exhibition, visitors can practice actions that served this and other goals, thus increasing the salience of inventive action possibilities and the likelihood that they will be incorporated within their identity systems.

Post-opening research

As specified in the NSF proposal, expectations for visitors' engagement in inventive identity processes in the exhibition were framed by theoretical and practical assumptions about experiences in a relatively brief visit to a museum exhibition. The proposal stated: "Given the DSMRI's nondeterministic, dynamic approach to conceptualizing inventive identity development as a feature of one or more role identities possessed by the visitor, we expect that the impacts of the exhibition experience on new identity activation and exploration will likely be varied and dependent upon where visitors are in their self-perceptions of inventiveness when they enter the exhibition. We do not expect global changes in identity after a single exhibition visit, but rather incremental shifts in self-conceptualizations about one's own capacity and agency. We posit that the manifestations of such shifts are likely to be found in behaviors and statements that evince re framing towards self-relevance, re-seeing content in ways that recognize sport as being intimately linked to processes of invention and innovation, and re-

enacting or re-imagining oneself as an inventor or innovator. Verbal impact indicators may be self-, or "I" focused on one's purpose and goals, one's beliefs, and perceived possibilities for action both within the visitor role as well as other role identities" (Smith, et al. 2021, p. 8).

The proposal further explicated the following expectations for identity processes in the CYG context among diverse visitors: "Using the DSMRI model, we understand that visitors will enter GC [CYG] with differing degrees of inventive identities. We expect them to verbally and/or behaviorally manifest identity shifts within a continuum of change from low to high. (1) At the minimum, GC [CYG] visitors will indicate some self-relevance to exhibition content (indicator: e.g., "The story of this invention is interesting;" coded as Visitor Role: No clear identity component). (2) Most GC [CYG] visitors will indicate exhibition content is self-relevant in at least one of the four DSMRI components (indicator: e.g., "As a woman, I am curious about women inventors in sports;" coded as Visitor Role: Components Self-Perception + Ontological and Epistemological Beliefs). (3) Some GC [CYG] visitors will demonstrate a shift in one DSMRI component (indicator: e.g., "At first I thought all inventors were male scientists, but now I know differently;" coded as Visitor Role: Shift in Ontological and Epistemological Beliefs). (4) Some GC [CYG] visitors will indicate a shift in more than one DSMRI component (indicator: e.g., "Now I see female athletes like me have contributed to sports inventions all along! Maybe I can too;" coded as Athlete Role: Shift in Ontological and Epistemological Beliefs + Shift in Self-Perceptions). (5) Some GC visitors will indicate a shift towards perceiving themselves as inventive in a role identity outside of the sports-related content of the exhibition (e.g., "Hey, I actually am inventive—in my DIY projects at home!" coded as DIY Identity Role: Shift in Self-perceptions+ Action Possibilities)" (p. 11).

The post-opening research sought to investigate these processes under the framework of the explicated expectations. In addition, the post-opening research was undertaken with the acknowledgement that the design-based research that informed the exhibition design was characterized by unique challenges, as the studied environment was only produced after the research was concluded, with very little opportunity for iterations. Thus, the post-opening research constitutes the first opportunity for investigating the way the design principles framed visitors' engagement in inventive identity processes. Consequently, the purpose of the post-opening research was to investigate visitors' engagement in CYG, the emergence of different participants' visitor role identities as they interacted with different exhibition contents, and

whether and how participants constructed self-relevance, utilized the big ideas to (re)consider inventive beliefs, goals, self-perceptions, and action possibilities, felt safe, and engaged in self-reflection, identity exploration, and transfer of inventive identity elements across life roles.

Method

Design

In this instrumental case study with embedded units (Stake, 1994; Yin, 1989), we combined naturalistic observation with semi-structured prompt questions to solicit participants' perceptions of the exhibition and their own inventiveness. Visits were structured to allow research and project evaluation data gathering. Researchers and evaluators collaborated to design the protocol and collect the data, but the cases reported here present the researchers' analysis and interpretation only. A summative external evaluation of CYG was also conducted by Kera Collective. Data collection events for the summative evaluation partially overlapped with the researchers and included joint observation of focal population visitors including some of the African American teen youth and visitors with disabilities. However, Kera Collective staff also gathered data from n=158 National Museum of American History visitors who had and who had not seen the exhibition and gathered feedback from the exhibition team about the processes used to develop the exhibition. Evaluators' findings are presented elsewhere (Kera Collective, 2024).

Participants

In developing CYG, the exhibition design team identified three priority audiences: African American youth (specifically boys) aged 10-17, girls aged 10-17, and individuals with disabilities of all ages. These priority audiences mirror the demographic characteristics of groups that are historically underrepresented in the American innovation ecosystem (Bell, et al., 2017). The exhibition team strived to develop and exhibition that would attract these audiences and promote inventive identity exploration, with the long-term goal of redressing underrepresentation among inventors. The six cases were selected because their demographics reflect the exhibition's priority audiences. Individuals were recruited through Access Smithsonian, a group-team within the Smithsonian Institution that provides accessibility services to visitors with disabilities and develops best practices for inclusive exhibition design. For this study, Access Smithsonian helped the researchers and evaluators recruit a group of individuals with a variety of disabilities who are experienced at providing feedback on exhibition design and visitor experience.

Similarly, the researchers worked with the Boys and Girls Club of Greater Washington to recruit African American boys and teen girls for the study. The two teens we closely observed for the research study were part of a larger group of approximately 15 teens from Boys and Girls Clubs who were invited to the museum to experience the exhibition and participate in focus groups by evaluators from Kera Collective. Working with the group's chaperone, we identified two teens who were willing to sit for our additional observations and questions reflected here.

Participants were all English speaking and included (1) K, an African American, female teen; (2) M, an African American-mixed race male teen; (3) C, an adult, Caucasian female with low vision; (4) an adult, Caucasian female with a disability from a progressive disease; (5) an elderly Caucasian female with limited physical mobility; and (6) An, a non-binary, neurodivergent Caucasian teen.

Procedure

Informed consent and informational needs were addressed ahead of participation. Once on site, individuals were welcomed to the museum by a staff member and were introduced to the researchers and evaluators. For adult participants and the accompanied teen, introductions took place near or at the entrance to the exhibition. For the teens who came to the museum with the Boys and Girls Club, introductions took place in the NMAH Cafeteria.

Access Smithsonian Expert Users

A verbal overview of CYG was provided to the participants. Ahead of exploring the exhibition, participants were asked to respond to a probe question about the degree of overlap between the characteristics of an inventive person and themselves. Participants were then invited to visit the exhibition following a path of their choosing. Researchers and evaluators accompanied the participants and took written notes about the participants' path, general behaviors in each zone, and responses to any probe questions.

Participants were encouraged to comment on what they were experiencing and were asked to elaborate if they provided ambiguous or partial statements (e.g. "interesting."). Visits were not time-tracked, but individuals spent approximately 60 minutes in the exhibition. At the end, participants were asked to comment on the initial probe question about the degree of overlap between the characteristics of an inventive person and themselves. Participants were thanked for their time and arrangements were made for them to receive an electronic gift card.

Boys and Girls Club Youth

While seated in a group setting, the teens participated in an interactive verbal introduction to the topic of invention and a brief verbal overview of CYG. Participants were also given a worksheet used by the project evaluation team. Ahead of exploring the exhibition, individuals were administered an "Inventive Me" activity (see Figure 3): they were given two paper circles with "An Inventive Person" and "Me" printed on them and were asked to indicate the degree of overlap between the characteristics of an inventive person and themselves using the paper circles (e.g. complete overlap, partial overlap, no overlap).

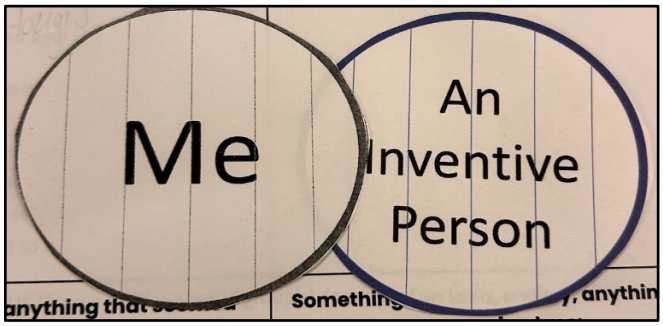

Figure 3. "Inventive Me" activity: Participants are asked to indicate their inventive self-definition by the degree of overlap between "Me" and "An Inventive Person"

Ahead of being dismissed from the cafeteria to visit the exhibition, the group leader identified two teens within the group who were willing to be observed and interviewed by the researchers. The group then adjourned from the cafeteria to visit the exhibition following a path of their choosing. Researchers and evaluators accompanied the participants. Researchers took written notes about the focal teens' path, general behaviors in each zone, and responses to any probe questions. Participants were encouraged to comment on what they were experiencing and were asked to elaborate if they provided ambiguous or partial statements. Visits were not time-tracked, but individuals spent approximately 30 minutes in the exhibition. At the end, the group reconvened and participated in a feedback session facilitated by Kera Collective staff. As part of the feedback session, participants completed the Inventive Me activity once again. Participants were thanked for their time and were given a gift card.

Data analysis

Researchers and evaluators prepared written notes that described the participants' pathway through the exhibition, the spontaneous or prompted statements that they made, and the interview transcripts. Notes were shared ahead of coding to ensure completeness and accuracy of analysis. The researchers coded the cases using the DSMRI Analysis Guide and Codebook (Kaplan & Garner, 2022). This multi-step process included close reading of each case; identifying salient role identities in the data (e.g. Smithsonian Access Group Expert User, Contracting Professional, Sister); coding of self-perceptions, purposes and goals, ontological and epistemological beliefs, action possibilities, as well as their associated roles and emotions, and the presence of one or more salient control parameters such as the domain; the preparation of a case summary that maintained the integrity of the flow of the visit; the preparation of a case synthesis that highlighted salient identity content, structure, and process; and researchers' discussion of each case followed by a cross-case analysis. Illustrative excerpts from the case analysis process are presented in Appendix C.

Findings

First, we present case summaries and syntheses for each of the cases. Then, we present the cross-case analysis to highlight common and unique aspects of visitors' experiences.

Case 1: K; an African American female teen, accompanied by two female friends

Case Summary

K self-identified as a 13-year-old African American female visited the exhibition as part of her Boys and Girls club. She mostly stayed together with Mi, another self-identified 13-year-old African American female and identified the two of them as "friends." For much of the time, they were joined by a third, African American presenting female friend. K was more vocal than M throughout the observation period.

Initial inventive identity

K and her friends completed the initial "inventive me" activity, presented in Figure 4, but due to the format of the visit, researchers were unable to ask them to elaborate on their initial inventive identity representations. K's initial inventive identity revealed less than 20% overlap of "an inventive person" and "me."

Competitive Edge

K's visitor role identity in this zone included practicing inventive actions towards a goal that was aligned with the zone theme, which was to be inventive to win. Her practiced inventive actions occurred during the Swimsuit Design interactive, where she spent several minutes. She observed others making and racing swimsuit designs and then stepped in to create her own. She uttered "one thing I learned…" as she made her selections and articulated an inventive goal "I want to make a men's suit." However, her first attempt was not ideal from her perspective. The game timed out of allowing her to select options and she interpreted these as ontological beliefs and self-perceptions: "I wasn't ready!" Her avatar subsequently lost the race, and she wondered "How the heck?"

K exercised the inventive strategy of iteration as she remained absorbed in the game, wondering about her avatar as she made her next selections: "How does he feel comfortable in that?" A second iteration was accompanied by an explicit inventive goal that was aligned with the competition theme of the exhibition zone: "I'm trying to win!" She carefully evaluated the myriad inventive action possibilities as she made her selection: "I like white...oh, glue, that's bad, sewn, that's bad." She was happier with her second creation, which also achieved her goal: "Yeah, she's winning!"

Health and Safety

In this zone, K constructed personal relevance by identifying objects that were familiar. Several objects caught her attention in this section, including the graphic image of the basketball hoop backboard shattering as a player dunks the ball into it, "Who did that? He looks ripped…strength to pull it down." In the 'Maximize your fitness potential' case she called out to her friend "It's a FitBit…it's a FitBit!" She had an apparent goal in identifying items in the safety gear case and its adjacent imagery: "Goggles are for swimming, that's obvious" and, in front of the pictures, "that's Lacrosse."

K enacted an inventive visitor role identity by participating in the Safety Remix interactive. Once again, she first observed another teen completing the activity. K and her friend sat down and read the introductory text. They selected the challenge of designing safe gear for skateboarding. K took the lead and explored and commented on inventive action possibilities in relation to the activity's goal, saying to her friends "What do you think about this?" "What if you fall?" and "We can choose between shin guards and knee pads." She watched the outcome and then read the conclusion aloud. When her friend chose snowball fight for the next iteration, she

coached her and expressed ontological beliefs about the materials, saying "You don't want something too heavy. Foam could work." K stayed to read the interactive's feedback and concluding text after her friend's attempt.

After completing the interactive, K and her friends walked over to view Shawn Springs' helmet and the image of the two football players colliding. K commented on the picture of the collision, saying "he could break his neck." She then gestured to the football player's displaced helmet and exposed neck in the picture, spontaneously articulating an ontological belief with an implied inventive goal aligned with the theme of the exhibition zone, saying "it should stay on your neck."

Fun for Everyone

K engaged passively with the content in this zone but enacted inventive strategies when using the Drawing Board interactive. K and her friend Mi browsed the Howard Head ski and tennis equipment case. M read the jog bra story and viewed the prototype. Mi attempted to engage K by asking "Did you read the thing about the sports bra?" but K was more interested in the Drawing Board interactive. As K engaged with the interactive, a facilitator asked Mi about what she found interesting about the jog bra story. M responded by offering an improvement to the design, saying "More support is needed. More padding around [the front] and up top." When K engaged with the interactive, the first iteration challenged visitors to invent a way to play basketball in hot lava on a pogo stick. She manifested a self-perception of not liking this combination and tried again. She found the next challenge, bowling in a street alley with snowshoes, acceptable. She expressed the self-perception, "That's not hard" and invited her friends "Let's draw the pins." She carefully drew eight bowling pins lined up in formation as if to be knocked down. Her friend commented "it would be hard to run in snow boots [shoes]." Mi and K read the conclusion aloud.

Fairness and Accuracy

K and her friends paused briefly at 'Invent to prevent cheating' with the picture of cyclist Lance Armstrong, but then walked back through Health and Safety to the End Zone.

End Zone

In the End Zone, all three friends exhibited active visitor role identities that leveraged the social context. They sat at the "Inventive Me" interactive and completed it together. They discussed the roles, goals, and self-perceptions (personal characteristics) on the bubbles. K

[about “watching sports”]: “This could be with my dad;” [about “inventing”] “That could be me;” she turned to her friends: “If you think of something, would you [invent]?” The musician bubble invited a discussion of their singing voices and some brief attempts at singing. When the WordCloud appeared, it reflected their collective inventive identities. Mi acknowledged this explicitly, saying, “Look at all of our stuff together!” They read the conclusion aloud.

All three teens completed the interactive What will you invent? and, with the provided pencils and paper, sketched and described ideas and designed in the form of new objects that fulfilled goals in everyday life roles, demonstrating transfer of inventive role identity elements to imagined roles beyond the museum. When asked about their drawings, K stated that she had an idea for “a vending machine for outfits.” Mi drew a “smart fridge that would tell you when the item expires.” When K asked her its name, Mi stated “I’m thinking. I’m debating. Smart fridge.” K declared “I have one of those. I can connect my phone.” Mi replied “I’ll give it a human name. The Dynasty, or the Destiny.” She then commented to K, “don’t steal my million dollars!” [from the invention] and “I’m gonna make Elon Musk hire me.” K expressed frustration with her drawing, with the self-perception of “I don’t know how to draw pants.”

Reflections on the exhibition

Evaluation staff from Kera Collective asked the group what they liked or what was surprising or confusing. K offered the following in her visitor role identity: “I liked how the exhibit teaches me things”, revealing emotion and self-perception aligned with ontological beliefs and a learning goal, and “I liked fair or foul, shows differences of opinions,” revealing emotion and self-perception aligned with ontological beliefs and an implied value. She was confused by “how the guy pulled the entire basketball hoop” and, in a different way, was confused by the jog bra story and its connection to women’s participation in sport, which she heard others talk about but was not observed to spend time viewing individually.

Revealing her post-Title IX generational perspective, she stated “the sport bra…if you are questioning [participation] just because it’s the opposite gender. Why is that even a question?” Moreover, the topic of gender equity in sport was personally relevant. She said “When my grandma was younger, and they rejected her because she was a girl. She was passionate about it [joining a sports team]. The one in the back [the jog bra story] to add girls in the sport. More people defend girls getting in now. Now it’s different than when she was a girl.”

When the group was asked to consider the characteristics of an inventive person, K stated

that an inventive person is “creative, artistic, outgoing, willing to share ideas. If you can’t get word out you have to tell people. You can conjure up ideas….[be] artistic. You can draw it. Someone can make it for you.” Mi indicated that inventive people are “smart, courageous.” When asked about being inventive in their own lives, K stated “Some people don’t say ideas out loud. You can think of it and not say it.”

Final inventive identity

K shifted her self-perception after her visit to the exhibition to be more inventive. She said, “I feel a little bit more [inventive]. I’ve seen how different people can be innovative. I see how I can be innovative.” At post-visit, her circles were approximately 75% overlapping (see Figure 4, below).

Initial “Inventive Me” **Final “Inventive Me”**

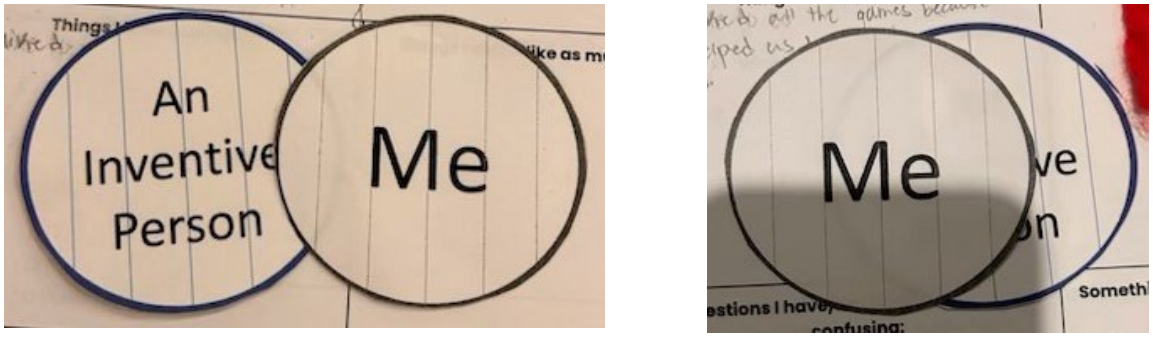

Figure 4. Initial and final “inventive me” representations by K, a 13-year-old African American visitor.

Case Synthesis

K, an African American female teen, exhibited an active visitor role identity when she engaged readily and positively with the interactive portions of the exhibition. As she did so, she articulated specific inventive goals and practiced specific inventive actions within a game-like environment. She also thoughtfully participated in creating with friends a collective inventive portrait using the Inventive Me interactive in the End Zone. She constructed personal relevance to the topic of invention outside of the domain of sport by generating ideas for inventions that would support her and others in everyday life roles such as young person choosing an outfit to wear. Upon concluding her visit, she indicated personal [generational] relevance for the topic of women’s participation in sport and revealed a slight shift in her inventive self-perceptions “I feel

a little bit more [inventive]." Her post-visit comments demonstrated that the stories of other inventive individuals had promoted this shift, as she stated "I've seen how different people can be innovative. I see how I can be innovative."

Case 2: M; a 14-year-old, African American-mixed race male

Case Summary

M self-identified as a 14-year-old mixed-race male. He visited the exhibition as part of the Boys and Girls club youth group. He spent the visit both alone and interacting with friends, primarily one main friend.

Initial inventive identity

Ahead of visiting *Change Your Game | Cambia tu juego*, M considered himself to be quite inventive, with a pre-visit high – though not complete – overlap between "me" and "an inventive person." He expressed the ontological beliefs that an inventive person is "a thoughtful person, smart, but a type of smart," "like in a class project, when you have an idea of what you want to do and change something," and his self-perceptions as being interested in inventing, by which he meant "struggling with things to make them better," with action possibilities that followed a suggestion of a peer of combining things together, like food: "food combination, like Mayo and Ketchup mix them together."

Initial impressions of the exhibition

M's exhibition visitor role identity seemed to be framed by his interest and knowledge in sports. For example, after the verbal description of CYG, in response to a facilitator saying, "End Zone," M implied self-perceived interest and ontological beliefs/knowledge of sports by gesturing "touchdown" with a peer. His role identity, interest, and knowledge in sports manifested prominently in other occasions throughout the visit and served as the basis for creating personal relevance – for example, later, when looking at the "vent to invent" exhibit, he commented "I have a bike just like this."

Competitive Edge

M's visitor role identity in the competitive edge zone included goals of seeking self-relevance to other role identities, primarily related to the domain of sports, but also to the domain of school, while also learning new ontological beliefs. His exhibition visitor role identity also involved action possibilities of reading labels, looking closely, and touching artifacts, and deep

engagement with positive emotions and inventive action possibilities with the interactive. For example, M played the Swimsuit Design game-like interactive with peers, manifesting immersive engagement, positive emotions like smiling and bumping fists when his swimsuit won the virtual race, and inventive problem-solving action possibilities, including touching the different textiles and talking about material properties with a peer, testing different materials (e.g., "we already tried spandex"), and changing the design and hypothesizing outcomes ("I think we're going to lose this. We're adding more drag because of the trunks"). He engaged with other artifacts as well – for example, asked "can you buy this still?" when looking at the Snurfers, and demonstrated ontological beliefs about the content: "Nice, creating a woman snowboard. Now they have kids' snowboards."

When asked about what he liked in the zone, M's statements revealed a process of "re-seeing" in aligned ontological beliefs, self-perceptions, and action possibilities in the domain of swimming and his role identity as a swimmer. Whereas he expressed a self-definition, action possibilities and implicit ontological beliefs as a swimmer "the swimsuit; I swim and I just wear my trunks and I don't think about it" he commented on his new perspective on the LZR swimsuit designers and scientists, saying "but they think—trunks or bodysuit. And the LZR suit, that it was so good that it was banned."

This reflects new ontological beliefs about swimsuit designers that highlight the discrepancy from his self-perceptions and action possibilities. Later, when reflecting on this experience in the stimulated recall interview, he expressed a shift in ontological beliefs stemming from engaging in inventive actions in the interactive and connected this to the STEM concept of designing to reduce drag forces:

> At first, I thought that a regular swimsuit would be OK. But then, when you try different materials, you try speedo, different quality materials, you see how big difference it makes. Different resistance.

M also manifested a clear response to the scaffolds for transferring the experiences in the museum to his role identities outside of the museum, explicitly reflecting on that transfer: "Like about the snowboard, I thought that when I was sledding I was trying to stand on the sled I'd fall over, it's cool that you can see how it connects to everyday life, like when I swim and I wear trunks, when you look at things and you can compare what you see in the museum to what you do in everyday life."

Health and Safety

M's visitor role identity in this zone involved goals of seeking self-relevance to self-perceived interests and role identities in sports, learning new ontological beliefs that was reflected in positive emotions, action possibilities of reading labels, looking closely at artifacts, and deep engagement with positive emotions and inventive action possibilities with the interactive. For example, he manifested positive emotional engagement, ontological beliefs relating to sports content knowledge, and adding content knowledge regarding protective gear: "Wow, compression" about helmets, and "that sliding pad, it's so different today. And this is for football neck protection, so cool how much things changed." In the Safety Remix interactive, M demonstrated inventive strategies (action possibilities) of considering different gear features for safety goals and testing and redesigning them. He explained to a peer the game and the gear considerations "knee pads would be good. We could try…," changed the gear and tried, "Let's go back and try again," selected a different game, "I feel like the hockey helmet would be good," and gave suggestions about different protective gear to a peer who was playing the interactive. In response to an evaluator's questions, he described his role identities as engaged in different types of sports: "I play baseball and this one (refers to the sliding pad) looks like an oven mitt. I did wrestling, baseball, football."

Fair or Foul

M's visitor role identity in this zone involved the goal of seeking self-relevance to self-perceived interests and role identities in sports, learning new ontological beliefs about cheating practices, and action possibilities of reading labels, looking closely and touching artifacts, playing the interactive with peers, and thinking about dilemmas. For example, together with a peer, M read the labels, touched the corked bats and over- and under-inflated footballs, and commented on the implications of deflating and inflating. He played the Fair or Foul interactive with peers, with M selecting the answer to questions and manifestly talking with peers and thinking about the content. For example, when a friend selected an answer, M commented "I agree," and when reading the question about banning ADHD medication in high schools, M said: "Well, it would depend on how severe the ADHD is."

The experience in Fair or Foul seemed to elicit ontological tensions that triggered exploration with potential lasting effects. In the stimulated recall interview, M described his engagement in "the question about transgender athletes" and his ontological belief that "you're

born with a certain gene and you play with someone else and it gives you unfair advantage," but also that "it was also interesting because some of the questions were not like yes or no and you had to think because it could be different outcomes. You need to do more in-depth thinking about it."

Fairness and Accuracy and Fun for Everyone

M's visitor role identity in these zones was similar to those in the other zones, but with somewhat less energy and engagement. M spent less time reading, talking, and interacting with the content. In Fairness and Accuracy, he read the label about adapting ideas from other sports, read the label and description and had a conversation with a peer about gender testing, saying that one does not have a choice about being a different gender, and stood and watched a peer engage in the interactive, but did not play it himself. However, his later description of his exploration of inventive aspects in this domain included reflecting on new ontological beliefs about the modification of equipment in light of his self-perceptions and self-definitions as a young person who is not playing professionally, demonstrating applying sophisticated conditional knowledge and contextualizing strategies: "I don't play major league, and I'm young, I think it is fair for my age. I think it's fine in that situation."

End Zone

In the End Zone, M's visitor role identity involved the goal of coming up with inventive ideas. His inventive action possibilities included making connections to the domain of school and getting a scaffold from another visitor's idea for a sport-related inventive idea. He seemed to respond to the scaffold question about identifying inventive ideas in life by noting to an evaluation staff member the problem of having many students who are asked to do research in the same big class, with students having different needs and requiring more or less help. He elaborated on this transfer and the conversation he had with peers about elaborating on ontological beliefs in tension and the implications for different action possibilities that led to a sense of unresolved role identity tension: "At first, we were talking about how it would be good for certain schools to have different classes depending on the resources that students need. And then we talked how this may make kids feel that they're less smart than other people. And we were talking how to solve this, because how do you solve this, and we were stumped."

M then manifested being scaffolded in thinking about inventive ideas by looking at the other visitors' ideas: "Oh, I just got an idea from what someone wrote." Later, he described this

as an action possibility he uses in his student role identity: “We have group projects that we do in school. And sometimes I get stumped there, and I go to another classmate who may be good in science, and I ask them, and they don’t give you the answer, but an explanation and you can understand better.”

The inventive idea that M generated related to a problem within a sports-related role identity and an inventive solution: “I play football, and the suit is bulky. But if you have one single suit instead of the different parts, that is lightweight with perfect amount of padding for protection.”

Final inventive identity

After visiting the exhibition, M depicted “Me” and “an Inventive Person” as full overlap, manifesting a change from not fully overlapping (see Figure 5, below). He indicated that through his visit in CYG he somewhat changed his ontological beliefs about being inventive as requiring high investment and big to be more day-to-day event, and correspondingly, his self-perceptions as more inventive:

> I changed it a little bit. At the beginning, I was thinking that sometimes I’m a little lazy. But then, I was thinking that it doesn’t have to be big. You can be inventive like in every day.

M's visitor role identity reflected a positive cognitive, emotional, and behavioral engagement in the exhibition that were based in a self-described shift from a default passive visitor role identity into an active visitor role identity due to perceived self-relevance to him as being very interested in and playing sports: “At first, I thought that it was going to be like an exhibit that you just brush pass it. But then when you get into it it’s a lot more interesting, because it’s connected to you, and it’s also interesting to see the professional things you have. How things turned out.” He concluded with a positive emotion about his engagement: “I thought it’s a really amazing exhibition. It really grabs your attention.”

A central aspect of M’s engagement and inventive identity change was his experience of ontological beliefs change related to how sports gear changed with time, connected to his self-perceptions and self-definitions as “big on sports” and loving “playing sports:” “I liked the ideas in my head, like the football equipment that is lightweight but it’s also protecting you from football that is dangerous;” “I liked how certain things, like protect and perform, and you’re able to see how the sliding glove looked a while ago and compare to what’s now. I liked that a lot. I

also liked how you're able not just to read about things, you see things;" "… being able to see what materials for swimming and how that works, and also the safety remix, that was super cool. And to see how equipment evolved over time and who created them." This re-seeing of the way gear has changed along time seemed to be an important experience for M, as the one he emphasized about telling others about the exhibit: "I'll tell them about this (the idea about the overall protective suit), and all the things, but the biggest thing is, it's super cool to see how the equipment changed, like the sliding mitt from an oven mitt to what it's today. Super safe. The progression."

M manifested an orientation towards deep inventive thinking: "I think, what are the possible outcomes. I don't want to stop thinking about it. You want to sum up all the possibilities and put them together in one batch that fits best. Like the best outcome."

Initial "Inventive Me": **Final "Inventive Me":**

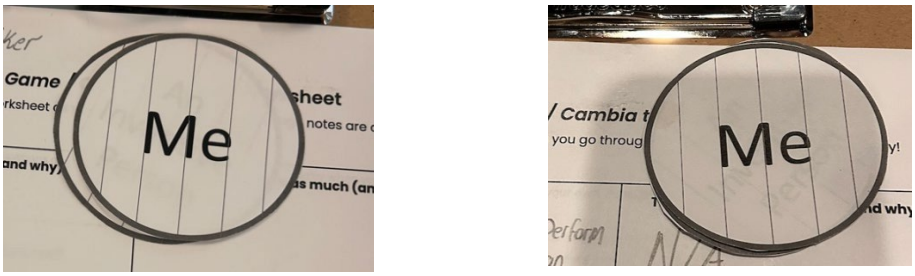

Figure 5. Initial and final "Inventive Me" by M, a 14-year-old African American-mixed race visitor.

Case Synthesis

M, a 14-year-old, mixed-race boy, shifted his visitor role identity from default passive to active and engaged, based in his perceived self- relevance of the content to his sports-related role identities and self-perceptions and self-definitions as playing sports, being very interested in sports, and knowledgeable about sports. His visitor role identity involved goals of seeking self-relevance to self-perceived interests and role identities in sports, learning new ontological beliefs that were reflected in positive emotions, action possibilities of reading labels, looking closely at artifacts, and deep engagement with positive emotions and inventive action possibilities with the

interactives, both on his own and often with peers. His engagement in inventive actions in the interactives contributed to change in ontological beliefs about designers and inventors in sports, and ontological beliefs about the change in sports gear reflected "re-seeing" the domain of sports gear and his own role identities as engaged in sports. Transferring experiences from his visitor role identity to his role identities in sports and in school were reflected in a shift in ontological beliefs about inventiveness from requiring intense commitment and big inventions to viewing being inventive as more day-to-day, and himself as more inventive at the end of the visit than at the beginning of the visit.

Case 3: C; a middle-aged, visually impaired Caucasian female

Case Summary

Initial inventive identity

Ahead of visiting *Change Your Game | Cambia Tu juego*, C was asked to describe the perceived overlap between the characteristics of an inventive person and herself. Her response was not limited to her museum visitor role identity; global disability-related self-perceptions and self-definitions were salient. She replied that there was a "75 to 100 percent overlap." C elaborated, "as an individual with disabilities, [I am] constantly being creative [to] accomplish a goal without the same opportunities." However, she elaborated on this to reveal a lack of perceived inventive action possibilities, saying, "I am an ideas person, I don't know how to turn them into reality."

Initial impressions of the exhibition

After a verbal description of the topic and layout of the exhibition, C commented that it "feels inspiring." She said she was "expecting a hands-on exhibit" and revealed positive emotions by saying that she was "looking forward to it."

Fun for Everyone

The first zone that C visited solicited salience for her visitor role identity and expert user role identity but also for non-visitor role identities that she holds. A facilitator provided a verbal description of this zone. C considered the content of one of the cabinets, which included Howard Head's skis. The intersectional domain of invention, sports, and science was salient; C asked if the skis changed shape over time or if the materials also changed. She connected scientific concepts across sports, saying that the skis would need to be "aerodynamic to move through the air and

snow…like figure skates."

C responded positively and thoughtfully to the prompt on the Howard Head exhibit cabinet: "What would you invent to maximize your skills?" She commented, "I like the question – thought provoking…other areas of your life." The idea of visitor-oriented questions throughout the exhibition appealed to her. She suggested that the museum "make a printout of questions to take and reflect. Keep for a rainy day. Parents talk with kids. Excellent questions for people who journal." She also considered that the questions could be used to make meaning around inventiveness after the visit, saying people could "talk later…if you take it with you, could change the game for people. Make it more impactful." This statement revealed an understanding of exhibition-related action possibilities that could bridge visitor and non-visitor roles.

C began to think about inventiveness in her everyday life and its relation to her visual impairment. She articulated inventive purposes and goals in a yoga learner role identity and revealed inventive action possibilities in this role. She described an idea related to her visual impairment. She said:

> [I'm] learning yoga…trying to find a 3D printer to…have a tactile representation of a pose, use phone app to plan sequences of poses…[to develop] a yoga mat that has gel to show where you are on the mat.

She then revealed an integration between her role identities of disabled yoga learner and inventor when she said she had already begun working on these ideas with her yoga instructor.

Drawing Board provides a randomized and often whimsical combination of a sport, an environment, and a constraint, and the visitor is encouraged to imagine and digitally sketch how that game play would work. C and another participant completed the Drawing Board interactive with the help of verbal description from a facilitator. The combination that they landed on was volleyball on a playground using household items. The facilitator read the options and created a depiction of their solution. C offered the inventive action possibility that a volleyball could be made from a "microfiber cloth with a balloon and a string." She added another inventive action possibility of using a "screen door and two shovels for a net."

In this zone, C's expert user role identity was salient when she commented on exhibit accessibility and content. A facilitator described the case containing the Quickie wheelchair and the video that described the story of the jog bra and its connection to Title IX and the increase in women's participation in sport. C stated that she would "like to hear the video narrated. It's

inspiring." When asked why it was inspiring, she revealed a connection between the domain and her beliefs about contemporary culture, saying "I was thinking diversity. Title IX. It's an issue right now."

Fairness and Accuracy

C's visitor role identity and the more specific expert user role identity were salient in this zone. She spent some time around the display "to catch a cheater." Both C and another participant touched the cut-out corked bat ("I expected it to be more cork"), smooth and roughened baseballs, and over- and under-inflated footballs ("I can barely tell it's underinflated.") She also returned to the topic of the skis and suggested that they be outside of the case so that they could be touched, to promote understanding for visitors with visual impairments.

Final inventive identity

Due to time constraints, C did not spend time in Competitive Edge, Health and Safety, or the End Zone. At the conclusion of the visit, C was asked to reflect on the same question about the overlap between the characteristics of an inventive person and herself. Her response connected exhibition content to her own conception of self and revealed exploration of her ontological beliefs. She stated that she was "thinking about the jog bra [story]. I would have accepted it. We make do because we have to." She reflected that she was thinking about "the women who [invented]…" and explored a belief from the perspective of her non-visitor role identities by stating, "What am I accepting that I shouldn't accept?"

C was asked about inventiveness in everyday life, which prompted this reflection on an ontological belief about what qualifies as inventive, and an example of her own past inventive actions as an individual with a visual impairment. She stated,

> We don't think something is inventive. I have a dumb example. Carabiner clips. Carrying big bags. Getting out of the cab, we [visually impaired individuals] can't go back and forth. I put my cane stick through handles of bags. I was in the container store [and found a] big carabiner clip with a foam handle.

Reflections on the exhibition

C was asked for her thoughts on the topic of the exhibition and its representation of individuals with disabilities. C commented on the potential impact of the exhibition, stating the ontological belief that it comes at a "perfect time in our culture. So much division and self-

absorption. Inspire people. Statements about including everyone. Incredibly powerful message. [Has the] potential to be one of the most life-changing exhibits the Smithsonian has ever done. The questions that are asked. Inclusivity."

C recognized the goal of the exhibition. She stated, "The change is you. You make the change." She elaborated that "It brings forth inspiration. It's up to them. Create the change." Her emotions were positive. C stated "You can leave feeling inspired. It's a good message."

The exhibition content prompted connections to everyday life. She referenced the Drawing Board interactive, saying "I'll be doing chores thinking 'could this be part of our volleyball game?'" She also integrated contemporary cultural issues into her reflection on the exhibition's goal highlighting of individuals' agency, saying

> With [artificial intelligence] AI, people are relying on it. A lot play with it, but people use it to create for them. [The exhibition] takes people to where you're the one that has to create. I can create. I'll do it instead of relying on AI.

Case Synthesis

C, a middle-aged, visually impaired Caucasian female, was able to balance her focus between feedback on the exhibition in her expert user role identity with inventive goals and actions in non-visitor role identities that included visually impaired yoga learner and shopper. She responded positively to both the invention and sports-related content of the exhibition and its inclusion of prompts for the museum visitor to consider and practice inventiveness in non-visitor roles. She entered the exhibition with a self-described "75 to 100 percent overlap" between the characteristics of an inventive person and herself. However, she initially described herself as an "ideas person" without the knowledge of how to be inventive. The exhibition prompted her to describe inventive purposes and goals in her role as a visually impaired yoga participant and inventive actions in her role as a visually impaired individual who has been shopping. C moved fluidly between the role of museum visitor making suggestions about ways to increase accessibility with her non-visitor experiences in everyday life.

At the conclusion of the facilitated experience, C explored her beliefs about her own agency; one of the VIP stories featuring women inventing to improve sports participation prompted her to ask, "What am I accepting that I shouldn't accept?" She articulated an appreciation for Change Your Game "to be one of the most life-changing exhibits the Smithsonian has ever done. The questions that are asked. Inclusivity." C further elaborated on

this by alluding to the exhibition's support for others' agency, and the use of the word "change" in the exhibition's title, by expressing the new belief that "the change is you."

Case 4: An, a middle-aged female with a disability from a progressive disease

Case Summary

Initial Inventive Identity

At the beginning of the visit, An responded positively to the exhibition's topic. She drew on her professional role identity as a contracting officer when she stated that there was "significant overlap" between herself and an inventive person. She clarified "not physical invention…my [action] is problem solving…I would say 50 percent [overlap]. You create and invent solutions and procedures. The patents office will tell you that's inventive."

Competitive Edge

An exhibited a moderately active visitor role identity by viewing a number of artifacts and reading the associated label text in this zone. She viewed the Snurfer (early snowboard), read the section on sneakers "Put Yourself in Someone's Shoes" but did not touch the tactile shoe parts, looked at the 3D printed wheelchair racing gloves made by Arielle Rausin, and read "Combine the best parts in new ways" label text. She read the Mike Schultz prosthetic story and "Vent to Invent" label text. An used the Swimsuit Designer interactive. She touched the material samples and was able to create a swimsuit within the time, but afterwards she stated "I had no idea what to press. I have cognitive issues from [medical disability]. I'll blame that." When asked for her impressions of the zone, she responded with positive emotions saying "It's cool. I like it."

Health and Safety

In this zone, An exercised a goal of viewing the content. She read the VIP story about Shawn Springs and looked at the equipment case. She watched a young female visitor complete the Safety Remix interactive. She viewed "Maximize your Potential" and the tackling dummy in its case. When asked if she had any reflections on this zone she said "No, nothing in particular."

Fairness and Accuracy

This zone elicited personal relevance and an exploration of ontological and epistemological beliefs about the domain of invention and inventiveness. An viewed the Adidas running bib, read the gender verification case and text, read "Channel your Frustration" "Instant

Replay" and "Invent to Prevent Cheating." She also completed the Fair or Foul? Interactive. She judged questions such as whether a disabled pro should be able to use a golf cart, and whether ADHD medications should be allowed in high school sports.

An's construction of personal relevance and interest originated from the big ideas that transcended specific artifacts in this zone and led to her reflecting on ontological beliefs about the interrelationship between invention and societal change. When asked to comment on her experience in this zone, she remarked "I think that's interesting" but stated the self-definition "I'm not a sports person." However, she said "for me, the invention is interesting. I think it's a cool thing to think about." She then explored three ontological and epistemological beliefs in the domain of invention and inventiveness. First, she stated "I was paying attention to content. How do we invent technology to address what people need?" Second, she noted the messaging in the VIPs' first-person accounts, saying "People are inspired to make change. 'This happened to me.'" Third, she considered the societal implications of inventions in this zone, saying "Thinking bigger than this is how I respond to [Fairness and Accuracy]…people being tested, they're the objects of the discussion. [It's] more societal."

Fun for Everyone

An went quickly through this zone although she did reveal self-perceptions and a personal connection to the Jog bra story in her parent role identity, saying "I'm a big advocate for sports bra innovation. My daughter is at the age where her and her friends are buying sports bras. They show the straps, they're colorful." She browsed through this zone, saying "It's a good order, natural flow" and "I feel like everyone knows that picture" of the female soccer player removing her shirt in a game.

End Zone

An continued to browse in this zone, and looked at several of the curated visitors' responses in the interactive What will you invent? She revealed positive emotions to the responses that listed edible tape for burritos and commented on the spelling mistake in the 'bedder (sic) education system' response, saying wryly, "not so much," and "these are great!"

Final inventive identity

An indicated that she would offer the "same response" to the prompt about the overlap between herself and an inventive person. She elaborated, revealing exploration of ontological and epistemological beliefs about the domain of invention in relation to the cultural norms in her

professional role identity as a contracting officer and her actions while occupying a parent role identity. Regarding her professional experiences, she stated "as a contracting officer, there's a very specific definition of invention. When I think about an exhibit like this and inspiring people to be inventive, I think about a broader definition like creativity. A more expansive definition." She also connected everyday inventiveness to intellectual property, saying:

> The stuff you make is intellectual property. It's yours. You don't need to go to an office. The idea that we all come up with solutions to problems. That's the first step.

Regarding her personal experiences in other life domains, she referred to cooking and crafting with her child, saying "at home, my kid and I were cooking…everyone comes up with substitutes" and "we were doing a craft. Didn't have this tool. I came up with the replacement." She also mentioned the inventive strategy of "what do I have on hand?" as an example of an everyday inventive action possibility.

Reflections on the exhibition

An's reflections revealed positive emotions and reflections on the domain of invention that involved an exploration of her ontological and epistemological beliefs. She said "I really enjoyed the fairness section. I'm not a sports person so the invention aspect was important [to me]. From a philosophical perspective, people were inspired to invent because of what they're going through. What we're going through as a society. They're very hard questions…the golf cart one. No? Hm?"

An commented that the VIP stories reflected individuals with resources: "I was reading different descriptions. People are like 'this happened to me and so I invented this.' All these people were in a position where they could do this. Where are these people? Why they had access to resources? It seemed they had their ability to invent with very expensive stuff…how do you have a lightbulb moment and invent something?" In addition, she commented that the representation of individuals with disabilities was limited, saying "How about disabilities that aren't 'I lost a leg'? The golf cart question…" which may have resonated since her disability involved reduced mobility and endurance.

Case Synthesis

An began the visit with strong perceived background knowledge regarding invention and innovation from her role identity as a professional contracting officer who interacts with

government agencies. This knowledge was more salient than her role identity as expert user or person with a disability, and ultimately supported a sustained self-perception of being creative instead of inventive. Despite a self-definition of not being "a sports person," An was intrigued by the individual and societal considerations surrounding technology related inventions. She explored her ontological and epistemological beliefs about the domain of invention through content in the Fairness and Accuracy zone.

Case 5: H, an elderly Caucasian female with limited physical mobility

Case Summary

Initial inventive identity

At the start of the visit, and in response to the verbal prompt about the degree of overlap between herself and an inventive person, H replied "There's overlap for sure…80% overlap." She provided inventive action possibilities originating from everyday life role identities:

> I like to use tools that aren't designed for that purpose. An example is I'll use a comb as a shoehorn. I'll use a shoehorn as a spoon.

However, H also articulated some limitations in her inventive self-perceptions, saying "I wish I knew more about engineering" and "I can come up with the idea but [I'm] not the person who will implement…I'm good with other people's ideas because I don't know what to do with my ideas."

H made positive comments about the text at the entrance to the exhibition. She articulated the self-perception "I'm a plain language advocate" and appreciated the short sentences presented at the *Starting Line*: "Who can be a Game Changer? Anyone." "Who is a Game Changer? You are."

Competitive Edge

In the Competitive Edge zone, H exhibited a moderately active visitor role identity that included aspects of her expert user role identity. She commented on difficulties with the lack of information about how to read a patent and the pace of the images in the interstitial videos. However, the content of the zone sparked an exploration of ontological and epistemological beliefs in broad domains beyond the museum visitor role. In response to the "Progress over perfection" text, H commented "That is a universal lesson. When do we ever reach perfection? I'd like to see that highlighted." She also commented in response to the swimsuit image, saying "What Speedo

did, that's nice, but what's important in life is teamwork."

Health and Safety

H exhibited active interest in the content of the zone. She constructed personal relevance through the Jack LaLanne story, saying "He was always on TV when I was growing up." She also drew from prior experiences; after seeing the interstitial video in this zone, she said "there is some discussion of the very high sugar content of Gatorade." She recounted interacting with a health and safety committee in the workplace and commented that safety should be listed first. H engaged with the Safety Remix interactive and spent several minutes following the directions, although she experienced a misalignment between her goal of getting the correct solution and the interactive's intended goal of open-ended, whimsical exploration of inventive strategies. She said afterwards, "What would be good is if they present the ideal. Offer practical solutions. Why can't I have [choose] the puffy coat and mittens?" In response to the text presented at the end of the interactive, she stated "It's not praising me for making good [correct] choices."

Fairness and Accuracy

This zone supported H in constructing additional areas of personal relevance. She drew on past autobiographical experiences living close to the Atlanta baseball stadium, saying "I would park my car at work and walk across and watch the baseball." She appreciated the tactile display that included the roughened baseballs and the corked baseball bats. However, when standing near the "Invent to improve officiating" label text, she began to construct deeper relevance that went beyond personal experience. She reflected, "this whole concept of technology to say what used to be human error." H connected ideas across zones, saying it goes back to perfection. Technology will give you perfection but is that the most important thing. Is it about winning or about the social aspect? I'd like more about that because we are juxtaposing [perfection] with process." The theme of contemplating ontological and epistemological beliefs in the domain of sport continued in response to the gender testing content and was received with positive emotions. H remarked:

> I really like this a lot. It focuses on a discussion topic of 'is winning everything?' Should people who are relying on a prosthesis or a gender change be prohibited from participating because it is about winning? It's not for the love of the sport.

Fun for Everyone

In contrast to Fairness and Accuracy, H was not captivated by the content in Fun for

Everyone. She was confused by the video images, although she did find the cheese head image on the wall amusing. She watched two families engage with the Drawing Board interactive but did not attempt it. The passivity of her visitor role identity in this zone contrasted with the contemplative reflection and engagement she had exhibited in the prior zone.

End Zone

H watched the video in the End Zone and remarked "[Invent to] help the planet, I like that." She then spontaneously reflected on a problem she was interested in solving at home, stating "I do meditation once a week. When I do, I see a color. Years ago, I bought this paint set. Now it is all dried out, but I have a basement and want to paint on the wall to try to replicate the color. I have to figure out how to do that."

H also gave an everyday life example in response to the interactive What will you invent? She stated, "I eat yogurt every day. I always wondered, what there could be to get every last bit out." She stated that she found a product that could solve her problem – a tiny spatula – and said "I didn't have to invent it. I only had to find it." Finally, in this zone H completed Be a Game Changer thoughtfully. She stated, "I'm surprised you don't have two of these." Her inventive portrait is shown in Figure 6.

Final inventive identity

When asked to comment at the conclusion of her visit, H indicated stability in her inventive self-perceptions despite acknowledging the inventive problem solving involved in wanting to paint the wall in her home and in wanting to find the perfect tool to use when eating yogurt. She reiterated, "I go back to ideate. I'm clueless on how to implement."

Case Synthesis

H, an elderly Caucasian female with limited physical mobility, began the exhibition visit with a strong self-perception of being "an ideas person" in the domain of invention. She was able to explore ontological and epistemological beliefs in the domain of sport by reflecting on the exhibition's content. H reflected on societal dilemmas of the importance of winning versus the importance of encouraging enjoyment and participation in sport, and, more broadly, the importance of teamwork. She was able to describe enacting inventive strategies (action possibilities) such as problem finding and using an object in creative ways.

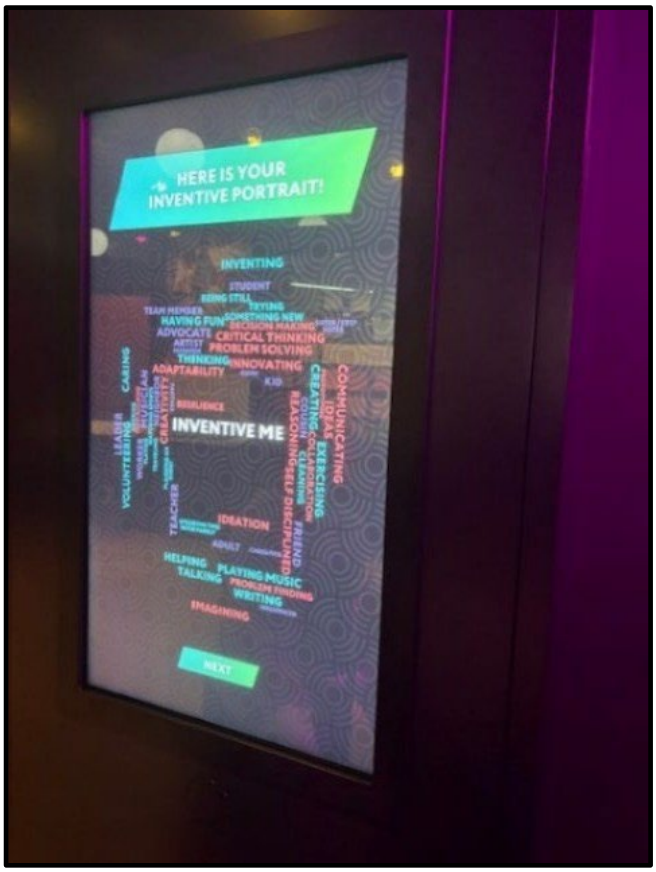

Figure 6. The inventive portrait created by H.

Case 6: A; a neurodivergent, non-binary Caucasian teen

Case Summary

Initial inventive identity

The format of the visit included a verbal prompt where A was asked to describe the degree of overlap between themselves and an inventive person. They responded that there is "a decent amount [of overlap]." A did not provide any examples of inventive actions or goals. A's mother, who served as a communication aide elaborated on A's response by referencing their dispositions by saying they are "creative, analytical."

Competitive Edge

As A and mom moved through the zone, the 'Access Smithsonian Expert User' role was highly salient for both individuals. This role identity was dominated by the goal of providing feedback about label positions, color, lighting, and label text. Comments focused largely on the

positioning and size of label text and how these could be improved. However, a second theme for their interaction was to comment and elaborate on the content. A did this spontaneously and in response to mom's statements. Upon seeing Mike Schultz' prosthetic leg, A pointed out to their mom that it was "a shoe, a boot…designed it to be like a boot. It has a toe clip. You click it, hit it, and push it down." In response to Arielle Rausin's 3D printed glove, Mom prompted personal relevance and an action possibility for A, asking "Is that something you can design in CAD?" A replied "probably." Moments later, standing in front of the case, A spontaneously connected the engineering design process of the gloves to engineering design action possibilities in her own life, saying:

> I look at something and [think] 'how would I make this?' Start from a block or an additive? If you model a measuring cup, start with the base and bring it up.

A struggled to generalize the big ideas about invention and sport in this zone to sports they were interested in. A expressed self-perception and ontological beliefs that their sports related interests were not common, stating that "many of the things aren't that interesting. Sports that are interesting aren't that mainstream. Like archery." A was overwhelmed by the visual complexity and number of user options in Swimsuit Design and initially said "I didn't realize that it was a game" when they came upon it. After watching others, A said, "I get it, make the most optimized swimsuit" but they did not play.

Health and Safety

The goals of an "Access Smithsonian Expert User" role identity continued to be highly salient for both A and mom. In this zone, they had an extended interaction about a large graphic of a basketball player smashing the backboard of the basketball hoop by leaning on the hoop as he dunked the ball. A did not have sufficient domain knowledge to understand what was being depicted and that it does not happen anymore due to the updated design, which was on display in a nearby but not immediately adjacent case. A looked at the graphic and said "Epic picture. Doesn't feel relevant. I don't watch basketball. I know it's not supposed to happen. This happened and what did they do?" Mom explained that the backboard was "too rigid, it shatters." A replied "[but] kids jump up and grab the basketball hoop." Then, looking in the case where a basketball hoop and a large black tackling dummy for training football players was displayed, A said "how [am I] supposed to know which is basketball? Trying to connect. I don't understand. Break because something hits it?" Mom pointed out that the artifact in the case did not have the

backboard attached. Acting in their expert user role identity, A stated that an idea to help the visitor would be "flipping spatially" to co-locate the artifact and graphic.

Without explicit scaffolding, A also struggled to transfer the ideas presented using unfamiliar sports to sports with which they were more familiar. Perceived relevance in this zone was associated with negative emotions due to past unsuccessful experiences with sports. When reviewing the display case containing an array of protective gear, A's mom commented on the featured sports that A's siblings were highly successful in, such as lacrosse and hockey. The reason for disliking competition came up in the social interaction between A and A's Mom. A stated "I don't like a lot of them [sports] because of the competitive aspect." Mom stated "I remember that from [you and] hockey. The goal is to take the puck or keep it." A revealed interconnected self-perceptions and ontological beliefs about different sports and games, saying "I hate class [school] games. Don't like how it feels. [I] like archery. Competing against myself."

The personal relevance of the topic of safety in sport was also associated with negative emotions about past experiences. A stated "I had concussions – one of them was not my fault…" "…getting ready to play flag football. I hear [name] and look up. Football in face…" and the self-perception "my head is a magnet. I need bubble wrap." When a facilitator pointed out a prompt question in label text within the zone, 'What would you invent to learn more about your body and improve performance?' A provided a response with implicit self-relevance, saying "Asthma. You have to exercise to overcome [it] but it hurts."

Fun for Everyone

In contrast to the other zones, A's visitor role identity was expressed through inventive actions and goals through the Drawing Board interactive. This interactive was perceived to be similar to activities that were familiar to A. They expressed positive emotions and became more engaged and at ease. A read the introductory text for the interactive and recognized the intent and the inventive strategy of sketching ideas. A was able to connect this to relevant domain knowledge, saying "That's another thing about CAD. The goal is to communicate it [the idea]." Mom recognized A's engagement and commented "much less overwhelming?" [than the swimsuit interactive].

In contrast to the other interactives, which presented unfamiliar tasks, A was able to complete Drawing Board independently. The inventive goal was to depict playing golf in the yard with household objects. A easily moved the graphic figures, used the eraser and the crayon

feature, and generated an idea for using popsicle sticks and a hook system to stop the ball from rolling off the sidewalk. A elaborated on their experience, saying that if this were a "CAD project, then I would [specify] radius, diameter….I like 'do you need more time?' [a feature of the interactive]. "…duct tape, that would be funny….[ball cup] moving back and forth like Thomas tracks…[finished sketch]" A perceived the finished product to be like prior design-oriented actions they had done, saying "This is what my sketches look like." During this time, when the social context and the inventive action possibilities were familiar, the expert user visitor role identity was much less evident.

End Zone

A once again chose not to participate in the open-ended, multi-step "What Would You Invent?" interactive, saying "too overwhelming, too much choice." They showed little interest in viewing other visitors' responses that were on display other than saying "I would be IDK [I don't know]." However, when asked what their invention would be, A generated one mechanical invention and two societal/social innovations.

The first idea emerged from A's student role identity and was a social innovation, to "un-stupid the IEP [Individualized Education Plan within special education] people." A followed this statement with an elaborate description of how text needed to be presented for them to learn. The second idea was drawn from A's learner role identity and came in response to a facilitator's prompt "What's a problem you see?" whereupon A described "I don't have a time machine. [The] Norse didn't write stuff down….[it was a] giant game of telephone."

Mom stated that accurately preserving ideas from this period of history was a deep interest for A. When the facilitator asked about a problem today that A could identify, they stated a second social innovation but in vague terms: "Politics. Social problems. Race, sexuality, legal solutions. Politicians are the people who are supposed to fix social issues." Mom stated that A would be reluctant to submit their problem and solution because "it's political" and therefore not appropriate for the exhibition space. A appeared to agree.

Final inventive identity

Mom spoke on behalf of A and stated, "we wouldn't change, but we were pretty high up there to begin with." When asked what the qualities of someone who is inventive might be, A added to the initial description by saying "someone who is not afraid to go out of their comfort zone." When Mom commented that the inventors seemed to come from privileged backgrounds

or contexts, A elaborated with an ontological belief, saying "people who need it the most are people who don't have access [to invention]." When asked for other comments about their experience, A responded that the exhibition was "more interesting" than expected. The 3D printing was mentioned as an example of something that was interesting. When the conversation turned to representations of individuals with disabilities, A once again evoked a familiar student role identity and remarked "what's good for special ed is good for everyone. If you don't understand something [the need for an accommodation] then you don't need it." Finally, A described that they had

> related to it [the exhibition] from a human standpoint. Living in a neurotypical society, being ADHD and autistic doesn't affect archery.

Case Synthesis

For A, a neurodivergent, non-binary teen, and their mom, the expert user visitor role was highly salient throughout the visit and involved goals of suggesting ways to improve the exhibition's presentation such as its text and images. However, A made connections between inventive processes within the stories included in the exhibition, and their own prior, design-oriented actions in learner and student role identities, for example designing objects using CAD and 3D printers. Although A began the visit by saying that there was a "decent amount" of overlap between an inventive person and themselves, the sport-related domain and its embedded invention-oriented motivations were not a close enough match for their specific topics of interest to spark transfer without additional scaffolding by others who were present. However, when the interactives afforded actions that were highly familiar to A in the non-visitor role of student or learner, they were able to generate a number of inventive action possibilities. Under supportive conditions, A was able to describe several non-sports invention-related interests, reflecting personal experiences in the role of special needs student with a personal interest in the domain of history.

Cross-case analysis

A cross-case analysis highlighted three main themes regarding common experiences shared by all six visitors, and three main themes that reflected individuals' unique experiences of the exhibition. The three themes of common experiences included: (1) all visitors constructed personal relevance to the exhibition content, including STEM and STEM-adjacent concepts, and

inventive actions in everyday life (2) all visitors manifested occasions of "re-seeing" aspects of inventions and inventiveness in sports and in other domains, and (3) all visitors manifested occasions of reflecting on and considering their own inventive identity in non-visitor roles, in some cases indicating initial identity exploration.

The three themes reflecting unique experiences included: (4) While some visitors spontaneously considered inventiveness in non-visitor roles, others needed scaffolding, (5) Social interaction influenced engagement but was different between the teens and the adults, and (6) The content elicited mostly positive emotions, but also negative emotions in some instances. Below, we elaborate on each of these themes.

Theme 1: All visitors constructed personal relevance of the exhibition content

Each of the six visitors manifested multiple occasions in which they expressed a connection between content in the exhibition and their own experiences, beliefs, and life roles. These connections occurred at different times during the visit, and the domain (e.g. sports, STEM, daily tasks) and content differed among the individuals.

K, the 13-year-old African American female, constructed personal relevance by identifying familiar objects in the Health and Safety zone, by relating to activities, like watching sports, in the Inventive Me activity in the End Zone, and by engaging cognitively and emotionally with the interactive games Design a Swimsuit, Safety Remix, and Drawing Board. M, the 14-year-old mixed-race male, constructed personal relevance in many of the zones by connecting different objects and activities to the various sports he is playing. He also experienced personal relevance through his immersive engagement with the interactives. C, the middle-aged visually impaired Caucasian female, constructed personal relevance by relating inventive motivations and ideas in the exhibition—for example, Howard Head's motivation to invent because of low ability in sports—to her non-visitor roles of disabled yoga learner and disabled shopper. An, the middle-aged female with a progressive disability, who self-identified as "not a sports person," constructed personal relevance by relating the inventive big ideas in the exhibition to her non-visitor roles of professional contracting officer, home-based roles as a cook and a mother, and her role as a disabled person in society. An did construct personal relevant with the sports bra, relating it with her role as mother to a daughter. H, the elderly Caucasian female with limited mobility, constructed personal relevance by connecting certain specific sports content to autobiographical memories and knowledge related to sports, but more

meaningfully constructed personal relevance of inventiveness ideas to ontological and epistemological beliefs about technology, teamwork, winning, and pursuing perfection. Finally, An, the neurodivergent non-binary teen, constructed personal relevance of sports to negative personal experiences, but also connected certain artifacts and interactives to their non-visitor role identity of designer using CAD and 3D printing tools to bring ideas to fruition.

Theme 2: All visitors manifested occasions of "re-seeing" aspects of inventions and inventiveness

Each of the six visitors indicated, in various ways, engagement in and change in their ontological and epistemological beliefs about inventiveness and being inventive. K indicated that the visit prompted her to see how different people can be innovative. M changed his beliefs from viewing inventiveness as something big to understanding that it can be a relatively small everyday event. C expressed her insight about inventiveness as a value-oriented agentic activity by diverse individuals. An expressed her understanding that inventiveness goes beyond creating physical objects to changing procedures and rules, and the connection of inventiveness and technology to promotion or hindering social values. H expressed an understanding of inventions as advancing societal value as well as the complexity of inventiveness and inventions, making a distinction between coming up with ideas and implementing and the centrality of collaboration and teamwork. And A explored their beliefs about the relation of inventions with competitiveness and design.

Theme 3: All visitors manifested occasions of reflecting on and considering their own inventive identity in non-visitor roles, in some cases indicating initial identity exploration

Each of the six visitors also reflected on and considered their own inventiveness in roles outside of the museum. Notably, some of the evidence for this cannot be separated from visitors being prompted to reflect before and after the visit, which served as a scaffold for such reflections. However, the reflections suggested desirable engagement in transfer of inventive ontological beliefs, self-perceptions, and some goals and action possibilities from the visitor to non-visitor roles. Some of the evidence implies initial identity exploration—for example, by suggesting that the visitor has elicited meaningful questions about themselves that they might continue to pursue.

K engaged in coming up with the innovative idea of a vending machine for clothes in the End Zone in which she applied inventive goals and action possibilities of ideating. She also

connected gender-related artifacts to exploring a personal narrative about her grandmother's experiences who was breaking gender participation barriers, suggesting the salience of gender social justice values. She expressed a certain change in her self-perceptions as inventive following the visit: "I feel a little bit more [inventive]...I see how I can be innovative."

M engaged in transfer of inventive identity elements to his role identities of athlete and student by ideating about lightweight protective gear and by considering the challenge of diverse ability classrooms. He indicated an explicit positive change in his self-perceptions as inventive, even if minor due perhaps to a ceiling effect: "I changed [my self-perception of inventiveness] a little bit. At the beginning, I was thinking that sometimes I'm a little lazy. But then, I was thinking that [invention] doesn't have to be big."

C articulated her self-perception as inventive through examples of the ways she is inventive in her everyday roles, indicating her belief in her agency to effect change through inventiveness. She also reflected on her experiences of being inventive with an example of using carabiner clips to handle shopping bags. Carrying big bags." While C recognized engaging in everyday inventive actions that stem from her personal needs, the experience in the exhibit also triggered broader and deeper self-reflective questions about her understanding of the world role as a visually impaired individual, and the potential for her to effect change through being inventive: "What am I accepting that I shouldn't accept?"

An expressed her self-perceptions as inventive by stating, "I would say 50 percent [overlap]. You create and invent solutions and procedures," which indicates her understanding of inventiveness as a problem-solving process. While An did not change the degree of overlap she perceived between herself and an inventive person, her elaboration indicated exploration of her ontological and epistemological beliefs about being inventive in her life roles as a professional and as a parent engaging in crafts with her child.

H also did not change her rating of herself as an inventive person and continued to self-perceive primarily as a person of ideas but not implementation. However, her engagement during the visit involved questioning and exploring ontological and epistemological beliefs and self-perceived values concerning different motivations for participating in sports, for inventing technology for sports, and of the role of collaboration and teamwork in inventing. She was also able to provide several instances of past and potential future inventive behavior in everyday life domains.

While A, through their mom, also did not change their rating of overlap between themselves and an inventive person, they did transfer inventive identity goals and strategies to other life role identities as a special education student and learner. They also elaborated on the meaning of being inventive in ways that suggested challenging themselves as a person with disabilities: "someone who is not afraid to go out of their comfort zone," suggesting a possible shift in understanding about how individuals, including themselves, could be more inventive to cope with experiences and challenges.

Theme 4: While some visitors spontaneously considered inventiveness in non-visitor roles, others needed scaffolding

While all six visitors considered inventiveness in non-visitor roles in their lives during the visit, their engagement in this reflection and transfer across roles varied. Some visitors, like M, C, H, and An engaged in role transfer spontaneously, early in the visit, and at different locations in the exhibition. The others, K and An, required scaffolds for such role transfer engagement. K only manifested transfer of inventiveness to her other life roles in the End Zone, through the scaffolds in the Inventive Me interactive and in design an invention activity, and later on through scaffolds of the facilitator in the group debrief with her peers. A required scaffolds from their mother for engaging in inventiveness and in transferring inventive identity elements to their non-visitor roles as designer and special education student throughout the visit. Notably, unlike these two teens (K and A), M constructed spontaneous personal relevance and transferred inventive identity elements from his visitor role identity to other life role identities. This is likely due to the salience of his role identity as an athlete playing multiple sports. M did require the End Zone scaffolds for transferring inventive identity elements to a non-sports role identity— student.

Theme 5: Social interaction influenced engagement and differed between the teens and the adults

All six visitors' engagement in the exhibition was influenced by social interaction with others including peers, family members, a museum staff member who acted as a facilitator, evaluators, and researchers. However, the nature of the social interaction with peers, and its framing of visitors' engagement, differed between the teen and adult visitors. Social interaction with peers among the Boys and Girls' Club teen visitors' engagement—specifically, K's and M's—was collaborative, consistent, and involved instances of collective engagement in which

the visitor role identity and its manifested actions were integrated across the peers—e.g., making collective decisions and taking collective actions in the interactives (both K and M), and completing the "Inventive Me" End Zone activity together (K). In comparison, social interaction among the adults with peers was sporadic, involved prompts by the facilitator, and was characterized by a focus on individual rather than the collective (except for mentioning shared experiences by visitors with a similar disability). An's engagement did not involve social interaction with peers, and it was further unique due to their disability that they required consistent social support from a trusted helper.

Theme 6: The content elicited mostly positive emotions, but also negative emotions in some instances

All visitors used emotional language at different moments in the visit. While most of these expressions were of positive emotions, some were negative. K and M expressed enthusiasm and excitement while playing the competitive Design a Swimsuit interactive and implied positive emotions in saying that they liked different aspects of the exhibition. K manifested curiosity when her expectations about her designed swimsuit's performance did not meet her expectations, and M expressed high interest in various artifacts related to the sports he plays. C felt inspired by the hands-on nature of the exhibition and by content of the videos, and positively intrigued by the self-reflective questions in the motivation zones. An liked the Competitive Edge motivation zone activities, demonstrated interest in questions about inventions and considering the Fair of Foul interactive questions, and enjoyed other visitors' inventive ideas. H expressed general positive emotions about the exhibition, and interest in the gender testing exhibit as an important and intriguing issue. However, she also felt frustrated by some aspects of the exhibition—when her goal of solving a challenge in an interactive was misaligned with the feedback she expected. A expressed some negative emotions during their visit, indicating being overwhelmed by the large amount of information and by the choices, and having negative emotions triggered because of prior experiences in sports that involved injuries.

Discussion

The themes found in the data suggest several meaningful understandings regarding visitors' engagement, learning, and identity processes in the context of CYG. These are as follows: (1) The CYG context affords opportunity for constructing personal relevance among

diverse visitors, (2) The CYG design scaffolds visitors' reconsideration of ontological and epistemological beliefs about inventiveness as more accessible to regular people, and (3) The idiosyncratic interplay among the CYG context and content, visitors' characteristics, and the social interactions in visitors' engagement and identity processes. We consider these in turn and then conclude by returning to the research questions mentioned earlier.

The CYG context affords opportunities for constructing personal relevance among diverse visitors

The finding that all six diverse visitors manifested multiple occasions in which they constructed personal relevance of the exhibition's content to their experiences, beliefs, and roles outside of the museum suggests that *Change Your Game | Cambia Tu juego context* includes numerous, varied, and evocative opportunities and cues to promote construction of personal relevance of the content among diverse visitors. Constructing personal relevance is a prerequisite for transformative learning and identity exploration as it provides the motivational foundation for considering the meaning of content and the implications of experiences of difference to one's beliefs about reality (ontological and epistemological beliefs) and about oneself (self-perceptions and self-definitions, goals, and action possibilities; Garner et al., 2016; Kaplan et al., 2014). The varied instances in which the teens and adults, who differed on many dimensions, related to the content of sports, invention, technology, and society, attested to the inclusive opportunities of the CYG context for relevance construction, raising the likelihood that many other diverse visitors would construct such personal relevance of the content and be more prone to engage in transformative learning around inventions and exploring their inventive identity.

A notable finding was that, while personal relevance and experiences were mostly associated with positive emotions and engagement, some visitors experienced negative emotions, when they experienced misalignment of ontological beliefs and goals—e.g., when expectations were not matched by the feedback in an interactive—and when content triggered difficult personal memories related to sports. This finding should not be considered as a shortcoming of the exhibition; negative emotions can serve as important identity exploration triggers, if the environment is experienced as safe to process these emotions and there are scaffolds to explore the implications for the self in constructive and growth-promoting ways (Flum & Kaplan, 2006).

The CYG design scaffolds visitors' reconsideration of ontological and epistemological beliefs about inventiveness as more accessible to regular people

The findings suggest that all visitors reconsidered their ontological beliefs about inventiveness. All six participants demonstrated instances of "re-seeing" inventions and inventiveness as not solely related to technologically complex or large-scale innovations but as including everyday problem- solving, recognizing that inventive people are diverse, understanding the inventiveness is value-oriented, that it can be applied in any life domain, and that it involves collaboration and teamwork. These shifts were mostly associated with positive emotions. Notably, particular emphases in the shifts in beliefs about inventiveness were different among the visitors, reflecting differences in their initial self-perceptions of themselves as inventive and the nature of their inventiveness, their engagement in different content and exhibits within CYG, the extent of their transfer of inventive experiences to their own roles outside of the museum. This finding should not be considered a shortcoming of the design principles or theoretical framing of inventive identity; the underlying assumptions are that individual, contextualized meaning making will occur when individuals enact museum visitor and other role identities.

Visitors' engagement and identity processes reflect an idiosyncratic interplay of the design and content, visitor characteristics, and the social situation

The variability among visitors that manifested in the content, occasion, type, and emotional valence of visitors' construction of personal relevance in the exhibition also framed the variability in their engagement and identity processes. This reflects an idiosyncratic interplay among the exhibition's design and content, the visitor's characteristics such as their developmental stage, interest and participation in sports, salient non-visitor role identities in their identity system and interests, and the social situation and social interactions they experienced during their visit. For example, visitors' variability in the spontaneity and need for scaffolds for engaging in reflecting on and transferring inventive identity elements to non-visitor roles reflected the interplay of the exhibition content—the self-reflective questions and Fair or Foul value-based dilemmas—their developmental readiness to engage in identity exploration, their salient role identities of sports-related or adult non-visitor role identities and interests, and the social interactions with peers or with others that scaffolded engagement in particular exhibits, reflection, and identity exploration. Clearly, the fact that the teens visited together with their

Boys and Girls Club group constituted a major contextual feature that contributed to their intensive social interaction with peers who were friends. While the adult visitors participated as part of the Access Smithsonian group, they arrived in small groups of two or three and did not know each other prior to the visit. Nevertheless, the nature of the teens' social interactions and their engagement in collective identity processes corresponds with their developmental stage of early-mid adolescence and reflects engagement that is likely typical of others of this age who visit the exhibition.

Conclusion

The *Change Your Game* | *Cambia tu juego* exhibition at the National Museum of American History was designed to engage diverse visitors in concepts of inventiveness through the lens of sports and in inventive identity exploration. Research on the experiences and engagement of six diverse visitors of different ages, genders, race-ethnicity, and disability status revealed both the complexity and variability of visitors' engagement, and the supportive nature of the exhibition's design elements and interactive experiences in promoting visitors' construction of personal relevance of the content, reflections connecting their experiences to their beliefs about inventiveness and self-perceptions as inventive, and exploration of the meaning of being inventive to role identities in their lives beyond the museum.

What theoretical model of inventive identity can we formulate from an analysis of inventive identity indicators and their shifts among diverse visitors?

Diverse visitors' experiences corroborated and expanded the DSMRI informed theoretical model of inventive identity included in the NSF AISL proposal. The DSMRI posited that individuals' experiences in the exhibition would be an emergent product of enacting a primary visitor role identity and connecting to it other role identities and their components (e.g. self-perceptions, goals, beliefs, and action possibilities) through a process of personal relevance construction, reflection, and action. Our research found this to be the case: our participants behaved like museum visitors (and, in some cases, visitors who were also Access Smithsonian Expert Users) by viewing or hearing about the artifacts, considering and reacting to the exhibition's big ideas about invention and inventiveness, engaging with one another and with the interactives, and spending varied amounts of time with material that was most or least interesting to them. With mixed degrees of spontaneity, participants drew on self-perceptions in domains

other than sports (e.g. being inventive as a cook), considered assumptions and beliefs in the domain of sport (e.g. gender equity and participation) and in other areas of life (e.g. government contracting), articulated inventive goals pertaining to sports (e.g. playing football) and other domains (e.g. learning yoga), and considered past actions and future action possibilities in which inventive strategies could be used to achieve a goal (e.g. sharing an idea for an invention, reconsidering what one is willing to accept). Such indicators were more likely to occur when prompted and were more likely to manifest through social interactions. *This suggests that although individuals' inventive identity can be integrated into (in this case) a museum visitor role identity, its change requires explicit attention to self-as-content.*

The DSMRI posits three facets to an identity system: content, structure, and process. Content refers to what an individual might state, believe, or otherwise hold as a self-perception or self-definition, purpose and goal, belief, and/or action possibility. For example, one of the participants stated the self-perception "I am an ideas person" and another stated "I have MS." Structure refers to the relations among the components, and their relative salience in a particular context. For example, the same participant who stated that they are an ideas person experienced tension between their strong self-perception as being a creative, inventive person and sparse perceived action possibilities for bringing their ideas to fruition. Process refers to the ways in which identity components evolve or remain stable through interactions with the environment. For example, two participants articulated ways in which they had implemented inventive strategies in the past, but their adherence to a normative, commercially oriented definition of invention led them to apply terms such as "creative" to these behaviors, even after engaging with the exhibition's content. We found evidence of inventive identity construction in different life roles, but manifestations emerged variably across identity content, structure, and process. In other words, and as originally proposed, the exhibition created a context for individualized pathways that visitors could populate with the role identities and expressions of role identity components that were most relevant to them. This meant that the form of inventive identity exploration that took place was not uniform across individuals, suggesting that *contexts seeking to promote inventive identity exploration will be most successful if they anticipate and support myriad avenues for participants' meaning making.*

In sum, the findings of visitors' variable emotional experiences, engagement, and inventive identity exploration corresponds with the DSMRI's conception of role identity and

identity exploration as a complex dynamic system that continuously emerges in not fully predictable ways from the situated co-action of contextual, personal, and situational characteristics. Within this complex identity system, inventive identity can be usefully conceptualized as a network of invention-related beliefs about the world, goals, self-perceptions and self-definitions, and perceived action possibilities that are integrated to different extent into, and are activated within, the person's different role identities in their life.

What can we conclude about exhibition design principles that the field can use to promote inventive and other STEM identity exploration and change among diverse groups of visitors?

CYG uses specific design elements and principles to invite identity exploration around the concept of inventiveness while simultaneously presenting the stories of "game-changing" inventors and inventions in the domain of sports and innovation. The design elements included conceptually and physically organizing the exhibit around big ideas of prevalent motivations for inventing in sports such as gaining a competitive edge and improving athletes' safety. Design elements also included statements and questions throughout the exhibition's text labels, interactives, and multimedia assets to affirm and promote visitors' consideration of their own inventiveness in everyday life roles. The design principles targeted visitor learning and identity development by supporting visitors' construction of personal relevance, seeing the world (including sports and invention) through the lens of the big ideas, and exploring their own inventiveness in various life roles.

The combination of these elements and principles draws from prior research on visitor learning and engagement in informal STEM learning settings (VINES; Garner, Carver, Page & Inwood, 2019; Garner, Kaplan & Pugh, 2016), the effective use of explicit prompts to support visitors' meaning making around scientific ideas (Carver, Garner, Kaplan & Pugh, 2021), and lifespan approaches to identity development and change (Flum & Kaplan, 2006; Kaplan, Bridgelal & Garner, 2020; Kaplan & Garner, 2017; Kaplan, Sinai & Flum, 2014). The cases of six diverse visitors reveal how the combination of the elements and principles and how they were leveraged towards the big idea of "everyone is inventive," prompted reflections across the intended engagement spectrum: considering STEM and STEM-adjacent *content* (e.g., the unsafe positioning of a football helmet, how to 3D print a prototype, the drag forces present on a swimsuit); re-seeing the world through big ideas (e.g., inventions having an impact even if they

reflect small changes to an existing item); and re-enacting and re-seeing the self as inventive (e.g. creating an object that can solve a problem).

Several adult participants commented on the exhibition's use of questions where the visitor was asked to reflect on their own life and their inventive actions in a role and domain of their choosing. One participant asked for a copy of the questions and indicated that they would like to journal about them. Similarly, participants were likely to recall as meaningful aspects of the exhibition that prompted consideration of issues in sports and beyond, such as the questions in the Fair or Foul? Interactive. Finally, objects and stories that were familiar to participants were likely to be recalled as being meaningful aspects of their experience. Familiar objects included the FitBit, the story of Jack LaLanne, the sports protective equipment, and the Jog Bra. Overall, but once again with variation and individualized responses, the exhibition's design including the presentation of dilemmas, self-reflective questions, and interactive activities, provided effective scaffolds for those visitors who chose to engage with them.

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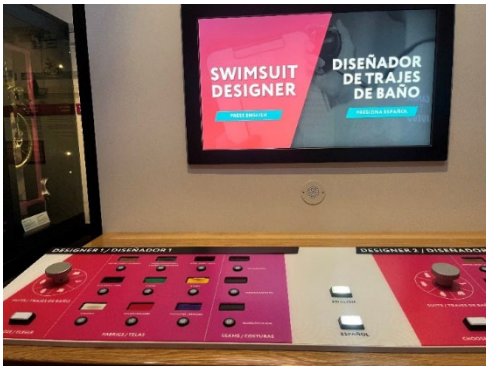
Appendix A. Floor Plan of *Change Your Game | Cambia tu juego*

Note: The red stars indicate the locations of the interactives.

Appendix B. Summary of the *Change Your Game* | *Cambia tu juego* Interactives

Swimsuit Designer (in Competitive Edge zone)

This interactive challenges visitors to outfit a competitive swimmer. They are prompted to choose the style (e.g. one-piece or bikini), fabric (e.g. cotton or nylon), and seam style (e.g. sewn or glued). The activity then runs a virtual time trial, and visitors are invited to learn and iterate: i.e., make new selections to see which combinations are fastest.

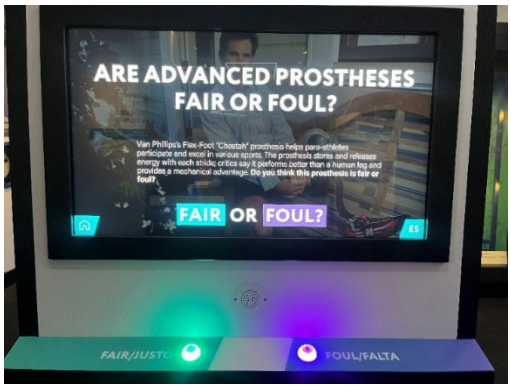


Safety Remix (in Health & Safety zone)

This interactive invites visitors to strike the right balance between safety and performance. The interactive invites visitors to consider how different combinations of protective devices (e.g. helmets, knee pads, but also whimsical gear like a suit of armor) would affect a person's ability to ride a skateboard or participate in a snowball fight. The activity helps visitors understand that trial-and-error testing is key to the inventive process.

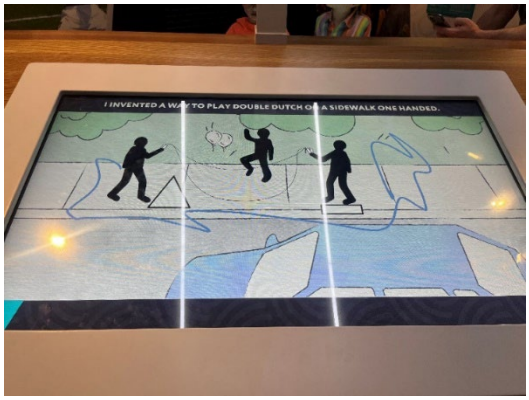
Fair or Foul? (in Fairness & Accuracy zone)

The "Fair or Foul?" interactive invites visitors to consider how emerging technologies, extraordinary athletes, and evolving social norms influence debates over questions of fairness in sports. Visitors are presented with a series of debatable sports-technology scenarios and asked to vote whether the situation is Fair or Foul. There is no right answer; visitors are simply encouraged to debate various norms while reflecting on their own ontological-epistemological beliefs. After voting on five scenarios, visitors are presented with a summary screen showing their votes, and how those compare historically against all previous visitors' responses (e.g. 40% voted Fair, 60% voted Foul).



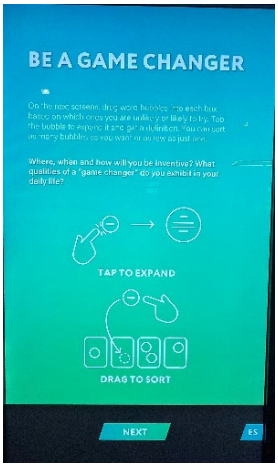
Drawing Board (in Fun for Everyone zone)

This interactive encourages visitors to exercise their inventive creativity by imagining and sketching how they might invent a game given a randomized set of whimsical constraints. For example, visitors might be invited to sketch how they play football on hot lava in a potato sack or play golf in a living room with only one hand. Visitors can then select from a menu of different elements that might contribute to their imagined game such as different balls, sticks, goal posts, and timers. Visitors can "spin again" and the randomizer presents a new combination of sport, playing environment, and constraint.



Be A Game Changer (in End Zone)

This interactive explicitly invites visitors to be self-reflective about their own inventive identities, while reminding visitors that there are many different ways to be an inventor. The activity station first asks visitors to think about activities that represent things they do every day that are inventive, e.g. playing, exercising, cooking, helping. Then it asks about roles visitors identify with: do you consider yourself a worker, a team member, a leader, an advocate? Finally, it asks visitors to consider their inventive strategies and how they like to get things done: By teambuilding? By imagining? By problem finding? By innovating? The interactive reminds visitors that "The things that you do every day are inventive" then presents a screen titled "Inventive Me" surrounded by a word cloud consisting of the different activities, roles, and strategies that the visitor self-selected on the earlier screens.



What Will You Invent? (in End Zone)

This interactive in the End Zone poses visitors with a rotating set of open-ended prompts toward inventive identity exploration such as: What problems have you solved in the past? How has this changed how you will address future challenges? Visitors are invited to write or sketch responses on paper and drop them in a secure box. The exhibition team vets and posts the most interesting responses as inspiration for future visitors.

Appendix C. Excerpts from Case Coding

Excerpt from Case K, African American adolescent female.

Context: 15 African American and mixed race teens/youth with Boys and Girls Club of America (DC chapter) came to the NMAH. They ate lunch in the cafeteria and then participated in a focus group that included a pre-visit discussion, a 30-minute period in CYG with a worksheet to complete, and a post-visit discussion on the plaza. Researchers followed two youth closely. M and K were two AA teen girls (age 13) who identified as "friends." They mostly stayed together throughout the exhibit and for much of the time were joined by a third friend, also AA female. K was more vocal than M throughout the observation period.

Transcript and observation notes	Coding
Competitive Edge	Role of exhibition visitor
Went to swimsuit designer interactive first. Watched others do it then took over the stools.	Self-perceptions (content).
K "one thing I learned…" [manipulated knob] "I want to make a men's suit." "I wasn't ready!" [it timed out]	Purpose and goals (content).
K "I'm trying to win!"	Purpose and goals (content).
Be a Game Changer	
K: "If you think of something, would you?"	Social context (with peers), domain of invention
K: "Inventor…could be"	Domain of invention, exploration of self-perceptions
Post-visit recall	
K: "I feel a little bit more [inventive]. I've seen how different people can be innovative; I see how I can be innovative.:	Self-perceptions (process) Social context (exhibition) informing change in self-perceptions, domain of invention.

Excerpt from Case C, adult, Caucasian female with low vision

Context: Small Access Smithsonian group of three participants. Two Caucasian females without vision, C accompanied by a guide dog and cane, V used a cane; E, a neurodiverse African American presenting male. All English speakers/communicators.

Transcript and observation notes	Coding
Inventive Me (Pre)	
C – "as an individual with disabilities, [I am] constantly being creative; accomplish a goal without the same opportunities. I am an ideas person, I don't know how to turn them into reality. 75-100% overlap."	Role of Exhibition Visitor, Co-activated role of Access Smithsonian User Expert. Self-perceptions and self-definitions (content) Action possibilities (content, limited)
Fun for Everyone	
C – asked if shape of the ski's changed or just the materials. "Aerodynamic to move through air and snow…like figure skates."	Domain of invention in sports Domain of STEM in sports
C – "I like the question – thought provoking…other areas of your life. Make a printout of questions to take and reflect. Keep for a rainy day. Parents talk with kids. Excellent questions for people who journal. Talk later – people come with questions. If you take it with you, could change the game for people. Make it more impactful."	Self-perceptions (liking the question) Personal relevance construction Action possibilities in non-visitor roles
Post-visit recall	
C – "perfect time in our culture. So much division and self-absorption. Inspire people. Statements about including everyone. Incredibly powerful message. Potential to be one of the most life-changing exhibits the Smithsonian has ever done. The questions that are asked. Inclusivity. The change is you. You make the change. It brings forth inspiration. It's up to them. Create the change. You can leave feeling inspired. It's a good message."	Culture control parameter Ontological and Epistemological Beliefs (about society). Non-visitor role. Positive emotions.