

APEX Coding Scheme

Created by [redacted]

Overview

We have developed a coding scheme for understanding participant interactions with co-creative museum installations. This coding scheme is based on Humphrey et al.'s Active Prolonged Engagement (APE) framework, as it is an established metric for understanding participant interactions with open-ended, co-creative museum exhibits (Humphrey et al. 2005). The APE framework considers four aspects of participant engagement with museum exhibits—physical, social, intellectual, and emotional.

We expanded the APE framework into a more reliable, concrete coding scheme, which we refer to as APEX (APE eXpanded). The APEX coding scheme as well as the video coding procedure are described in detail below.

What types of installations is this intended for?

APEX is intended as a tool for understanding participant interactions with co-creative exhibits. These exhibits are typically collaborative, meaning that multiple people are able to interact together at the exhibit and socially engage with each other. They are also creative or expressive, meaning that they facilitate creative exploration and there is no predefined outcome for the visitor. Visitor experiences can be shaped by their motivations and interests, and outcomes often look different from group to group.

What types of questions will APEX answer?

We list a number of evaluation questions that APEX can help you to answer below. You can choose to perform a full APEX analysis if you wish to answer all of these questions, or you can analyze using only a subset of the coding scheme (e.g. social codes) if you are interested in only one dimension of participant engagement at your exhibit. Applying APEX to multiple exhibits can allow for a comparative analysis.

- How are participants at my exhibit socially engaging with each other?
 - Are they mostly working independently or are they collaborating as a group?
 - Is one member of the group taking charge and acting as a teacher or a leader, or are all members contributing equally to the interaction?
 - When/how often do moments of discord or social conflict occur?
 - Does the nature of social interaction change over the course of a participant group's interaction with the exhibit?
 - How does the nature of social engagement change from exhibit to exhibit? For example--are some exhibits in my museum better at facilitating collaboration than others?

- How are participants engaging physically with the exhibit?
 - Are they using all of the exhibit components in a coordinated manner, or are they simply testing out isolated components in a haphazard way?
 - Are the interaction dynamics with my exhibit easily apprehendable (Allen, 2004) to visitors?
 - Does the nature of physical interaction change over the course of a participant group's interaction with the exhibit?
 - How does the nature of physical engagement change from exhibit to exhibit?
- How are participants engaging emotionally with the exhibit?
 - When/how often do participants exhibit positive/negative emotional responses?
 - Does the nature of emotional engagement change over the course of a participant group's interaction with the exhibit?
 - How does the nature of emotional engagement change from exhibit to exhibit?
- How are participants engaging intellectually with the exhibit?
 - Are participants engaging in learning dialogue with each other while interacting with the exhibit?
 - When/how often do participants seek information by asking questions?
 - When/how often do participants share information by making observations or hypotheses?
 - When/how often do participants apply prior knowledge to their interaction or engage in planning/goal-setting activities?
 - Does the nature of intellectual engagement change over the course of a participant group's interaction with the exhibit?
 - How does the nature of intellectual engagement change from exhibit to exhibit?

Data Collection & Preparation

Recording Video

Consult with your local IRB and obtain necessary approval prior to video recording participant interactions. Most accurate data will be obtained by filming “in-the-wild” rather than in a classroom setting, although the codes can (and have been) applied to classroom interactions (reference redacted). If a comparative study is being conducted, we recommend recording both exhibits in the same environment (on-the-floor vs. in a classroom). If recording on the museum floor, we recommend following Gutwill et al.'s procedure of posting signage at the entrance of the exhibit as well as on exhibit elements and the camera itself to inform people they are being video recorded (see Gutwill et al., 2003 for more details).

Consider recording video of your exhibit from multiple angles—for example, when working with a tangible tabletop exhibition, we recorded interaction from both a top-down view (with a camera mounted to scaffolding above the exhibit) and a side view (shown below). We also strongly recommend placing additional microphones close to where visitors will be speaking (e.g. hanging down over the exhibit or embedded in the exhibit), as it can often be difficult to hear what participants are saying, especially if the exhibit is located in a large room with other

installations. Make sure that your microphone picks up the participants voices over the noise of the exhibit itself (we recommend testing this prior to conducting the evaluation).



Preparing Video for Analysis

Video and audio will need to be synced up prior to analysis. We separated the continuous video stream into separate recordings corresponding to each “group” that interacted with the system. Research has shown that tracking and separating groups interacting with exhibits “in-the-wild” is quite complex (Block et al., 2015). We suggest two approaches to alleviate this challenge: 1) develop a set definition of what defines a group beginning/ending an interaction, and apply that consistently to the analysis, and/or 2) if you conduct interviews or questionnaires with certain groups, those can be the groups that you analyze in subsequent video analyses.

When analyzing videos, we establish a fixed unit of analysis in order to avoid discrepancies resulting from subjective variability in both the unit of analysis (*when* the event is taking place) and the code (*what* is taking place). Each video is divided into a series of 10 second segments and each code is given a ‘1’ if it occurred during that time segment and a ‘0’ if it did not occur (this is called a “one-zero sampling” approach in the literature (Smith 1985)). We have used both Excel spreadsheets and the coding software Atlas.TI to break videos down into 10 second segments—you may use your preferred method/software. For intellectual codes, which rely more on the content of verbal utterances, we transcribe the dialogue in the videos and ascribe one code to each line of dialogue (using an Excel spreadsheet). This procedure is adopted because we have found in prior experience that multiple lines of dialogue often appear in a single 10 second interaction segment. For transcription, we typically have one analyst transcribe the videos and a second analyst check the transcription for mistakes before analyzing the video.

Establishing Inter-Rater Reliability

Establishing inter-rater reliability is important in order to ensure that multiple analysts deliver consistent results when analyzing the same data. We recommend that two analysts each analyze a subset of the recorded videos and calculate an inter-rater reliability score using that data. We use Gwet’s AC1 statistic (2008) to calculate inter-rater reliability, due to a recognized issue with Cohen’s Kappa when it is calculated for data in which certain events are rare (e.g. codes like discord or positive/negative emotion) (Viera et al. 2005). The AC1 statistic is an alternative to Cohen’s Kappa that corrects for this issue while still accounting for chance agreement (Gwet 2008).

Live Observation

For researchers/evaluators interested in understanding participant engagement who do not have the time or resources to devote to a fine-grained video analysis procedure, we provide forms for live observation. We provide both a physical form and a virtual form. While the data collected with these forms does not provide the depth and detail of a full APEX analysis, they should give a high-level understanding of participants' social, intellectual, physical, and emotional engagement with a much lighter time/resource commitment. Observations can also be used to provide more rapid/instantaneous data to supplement the more lengthy video analysis process. The coding scheme presented later in this document should provide adequate context for the observation form.

Coding Scheme

This section outlines the four dimensions of codes that comprise the APEX coding scheme—physical, intellectual, social, and emotional. For each dimension, we provide a brief overarching description. We outline a general definition for each code but we leave the “specifics” section blank to allow you to customize the coding scheme to your exhibit(s). Examples of specifics that have been filled in for other exhibits are provided at [link redacted]. We include a set of “keywords” for each code as well as a set of notes and guiding questions (where relevant) to aid you in filling out examples specific to your exhibit for each code. We recommend observing participants engaging with your exhibit after reviewing this coding scheme and using your observations to fill in the “specifics” section with examples. Specifics may need to be iteratively revised and added to during the early stages of observation. After establishing the specifics of the coding scheme, two analysts should establish inter-rater reliability before moving forward with the analysis.

Physical Engagement

Physical engagement refers to the ways in which visitors interact physically with an exhibit by engaging in hands-on manipulation of the tangible aspects of the installation. We describe physical engagement using three codes: *isolated manipulation*, *investigative manipulation*, and *integrated manipulation*.

Notes/Guiding Questions

- Focus on observable actions when defining specifics for physical codes (do not try to infer visitors' intent or inner thoughts). Coding videos while muted can help analysts focus on observable physical actions only.
- What physical components can participants interact with at your exhibit? Begin by making a list of the physical components of the exhibit that participants will interact with. Interactions involving single components are indicative of *isolated manipulation*, whereas interactions involving multiple components are indicative of *investigative* or *integrated manipulation*.
- Exhibits in which facilitators interact with and guide visitors **should NOT** include the facilitator as a participant for physical analysis.

Code Name	Code Description
P_IsolatedManipulation	<p>General: Participants are physically interacting with the exhibit, initially testing/touching/trying out components in isolation to determine how individual pieces work.</p> <p>Keywords: trying out individual components, potentially unsure, disconnected, haphazard, isolated</p> <p>Specifics (_____):</p>
P_InvestigativeManipulation	<p>General: Participants are beginning to explore how the exhibit works by testing out two or more components together, but are not yet fluidly integrating multiple components in a complex sequence of actions. Participants are investigating the relationship among multiple pieces.</p> <p>Keywords: coordinating multiple elements, investigating relationships, testing</p> <p>Specifics (_____):</p>
P_IntegratedManipulation	<p>General: Participants are fluidly integrating multiple components in a complex sequence of actions. Participants are no longer investigating/testing and are now engaging in goal-oriented connection of multiple exhibit components.</p> <p>Keywords: executing complex actions, goal-oriented, fluid interaction, expressive, composing, confident, advanced components, integrating multiple components</p> <p><i>(Note: if the fluid action occurs over two time segments, only the second will be coded as integrated)</i></p> <p>Specifics (_____):</p>

Intellectual Engagement

Intellectual engagement deals with “the connections visitors make to existing knowledge during their interaction, the conceptual understandings [they gain], and the questions they have” (Humphrey et al. 2005). We break down intellectual engagement into three distinct categories: *seeking knowledge, sharing knowledge, and applying knowledge.*

Notes

Exhibits in which facilitators interact with and guide visitors **should NOT** include the facilitator as a participant for intellectual analysis.

Code Name	Code Description
I_SeekingKnowledge	<p>General: Participants seeking more knowledge about the experience. Seeking Knowledge encompasses two types of behaviors:</p> <p><i>Asking Questions:</i> Asking questions about how aspects of the exhibit work (to oneself or others) and/or asking questions that promote curiosity or further engagement with the system. This does not include extra-diegetic (i.e. unrelated) information or questions. Focus more on the inquisitive intent, and less on the grammatical form (i.e. “We didn’t get the idea” is asking an implicit question, even though it’s a statement).</p> <p><i>Confusion:</i> The user expresses confusion about an aspect of the system that violated their expectations. Interjectional "hmms" that don't relate to confusion do not count, or "hmms" when users are simply thinking out loud.</p> <p>Keywords: Seeking more knowledge; questions/confusion about how the exhibit works and about what one might learn from the exhibit;</p> <p>Specifics (_____):</p> <ul style="list-style-type: none"> • <i>Questions about exhibit:</i> • <i>Questions that promote engagement:</i> • <i>Confusion:</i>
I_SharingKnowledge	<p>Participants sharing knowledge about the experience. Sharing Knowledge encompasses two types of behavior:</p> <p><i>Voicing Observations:</i> Verbalizing what is happening in the exhibit (including reading signage or other information about the exhibit); noticing that something is occurring. This includes aesthetic observations (e.g. "This is cool."), but not aesthetic decisions (e.g. "Do ___ because that looks/sounds nice."). This does not include observations about unrelated things (e.g. "It’s getting late") or observations about the state of other participants (e.g. "Oh you are just playing").</p> <p><i>Explaining:</i> Offering an explanation or hypothesis for how they think the system works, even if it is incorrect; explaining 'why' something is happening.</p> <p>Keywords: voicing observations about the exhibit or what they are learning through the exhibit; explaining/hypothesizing about how the system works or about the underlying concepts.</p> <p>Specifics (_____):</p> <ul style="list-style-type: none"> • <i>Observations:</i> • <i>Explanations:</i>

I_ApplyingKnowledge	<p>General: Participants applying their knowledge of the experience by planning or directing action. Applying knowledge encompasses multiple behaviors:</p> <p><i>Proposed Solutions:</i> Participant verbally proposes a solution to a problem they are trying to solve. This follows a violation of the user's expectations of how the system works.</p> <p><i>Planning:</i> Verbally proposing a goal or plan for the group. This should involve more than one step, be goal-driven, and move the group to a place where someone can conduct.</p> <p><i>Conducting:</i> Telling or suggesting to another participant how to contribute to the composition; a command. This does not include proposing a goal for the group, but is rather a singular, action-driven process.</p> <p><i>Aesthetic Decisions:</i> Choosing to incorporate elements they like, discarding or removing elements of the activity they find displeasing. This does not include aesthetic opinions that do not result in a decision (e.g. "That looks/sounds nice!")</p> <p><i>Prior Knowledge:</i> Explicitly, verbally relating the exhibit to other experiences in school, life, exhibits, etc.</p> <p>Keywords: Proposing a solution; making a plan for the group; telling another participant how to contribute; making choices based on aesthetics; applying prior knowledge.</p> <p>Specifics (_____):</p> <ul style="list-style-type: none">• <i>Proposed Solutions:</i> • <i>Planning:</i> • <i>Conducting:</i> • <i>Aesthetic Decisions:</i> • <i>Prior Knowledge:</i>

Social Engagement

Social engagement has to do with with “the many ways in which visitors influence each other's experiences at exhibits” (Humphrey et al. 2005). We describe social engagement using three different binary scales: *independence vs. collaboration*, *harmony vs. discord*, and *active/passive vs. equal partners*. One code from each of these binary scales is applied to each 10 second segment of a video.

Notes/Guiding Questions

- Two of the scales, *independence vs. collaboration* and *harmony vs. discord*, may be viewed as dominant and nondominant pairs—that is, the nondominant code will only be applied in the absence of any indicators of the dominant code. *Independence* and *harmony* are nondominant; *collaboration* and *discord* are dominant.
- What are some constructive, shared goals that participants might pursue when interacting with your exhibit? Defining one or more constructive goals based on initial observations of participant interactions with your exhibit will aid in differentiating collaboration from independent work.
- Exhibits in which facilitators interact with and guide visitors **should** include the facilitator as a participant for social analysis.

S1_ActivePassive	<p>General: There is an active/passive relationship between the group members (visitors and any facilitators present). This means that some members in the group take on an active role, and some members in the group take on a passive role. Active = teaching or directing/suggesting the action (e.g. explaining/narrating the experience, using facilitating language like "What do you think you should do?"; using conducting language like "put that there"). Passive = members that are listening/observing/doing what they're told, or failing to take part in an active role.</p> <p>Some examples of active-passive group dynamics include:</p> <p><i>Teacher-Apprentice</i> (teacher is explaining exhibit, apprentice is listening and/or asking questions of teacher)</p> <p><i>Facilitator-Follower</i> (facilitator is asking guiding questions, follower is looking for answers)</p> <p><i>Leader-Follower</i> (leader is setting a course for the group, follower is doing what is suggested)</p> <p><i>Taskmaster-Worker</i> (taskmaster is giving specific instructions, worker is carrying them out)</p> <p><i>Actor-Observer</i> (actor is interacting with exhibit, observer is watching interaction or exhibit)</p> <p><i>Actor-Commentator</i> (actor is interacting with exhibit, commentator is remarking on exhibit but not interacting)</p> <p>Keywords: leader and follower dynamic, members contributing unequally</p> <p>Specifics (_____):</p>
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S1_EqualPartners	<p>General: Any dynamic that is not active/passive. Either no one in the group has taken on an active role OR everyone in the group has taken on an active role. This may involve turn-taking between all members within a segment.</p> <p>Some examples of equal partners group dynamics include:</p> <p><i>Actor-Actor</i> (all group members are interacting with exhibit)</p> <p><i>Commentator-Commentator</i> (all group members are remarking on exhibit but not interacting with it)</p> <p><i>Taskmaster-Taskmaster</i> (all group members are giving specific instructions)</p> <p><i>Observer-Commentator</i> (observer is watching exhibit, commentator is remarking on exhibit)</p> <p><i>Teacher-Facilitator</i> (teacher is explaining exhibit, facilitator is asking guiding questions or suggesting a course of action)</p> <p><i>Leader-Taskmaster</i> (leader is setting a course for the group, taskmaster is giving specific instructions)</p> <p>Keywords: equal contribution, no dominant member, all guiding action equally</p> <p>Specifics (_____):</p>
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S2_Discord	<p>General: A <i>social conflict</i> such as a disagreement, an interruption, or a disturbance to others' play - a break in the harmony. Although it does not necessarily have to be associated with a negative emotional response, it should in some way disrupt the flow of the play experience.</p> <p>Some examples of discord include:</p> <p><i>Conflicting Goals:</i> group members hold differing creative goals and conflict arises from deciding how to proceed</p> <p><i>Opposing Hypotheses:</i> group members hold differing ideas of how the exhibit works and conflict arises from figuring out which one is correct</p> <p><i>Taking Control:</i> one or more group members attempt to take control of the actions happening on the table and/or take over the work of others</p> <p><i>Limited Space/Materials:</i> group members fight over scarce resources (such as sample blocks or space at the table)</p> <p><i>Disruptive Distraction:</i> discord unrelated to the exhibit; often small children drawing attention away from the play experience</p> <p>Keywords: conflict, disruption, controversy</p> <p>Specifics (_____):</p>
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S2_Harmony	<p>General: Working together in the absence of social conflict (not necessarily working together joyfully).</p> <p>Specifics (_____): no indicators of discord are present</p>
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S3_Collaborative	<p>General: At least two members of the group (visitors and any facilitators present) are collaborating (i.e. actively working towards a constructive, shared goal). Collaboration can be physical (e.g. working together on the same task) or verbal (e.g. directing or planning together).</p> <p>Keywords: working together, sharing space or tools, shared planning</p> <p>Specifics (_____):</p> <ul style="list-style-type: none"> • <i>Physical indicators of collaboration:</i> • <i>Verbal indicators of collaboration:</i>
S3_Independent	<p>General: No one in the group is working collaboratively (as defined in S3_Collaborative) .</p> <p>Keywords: working alone, parallel play, individual play</p> <p>Specifics (_____):</p>

S4_NoCode	<p>General: Only one person is present at the table.</p> <p>Keywords: one person, no social interaction</p> <p>Specifics (_____):</p>
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Emotional Engagement

Emotional engagement deals with the “nature and intensity of the affect exhibited by visitors during the engagement and immediately after” (Tisdal 2004). The nature of the emotional engagement may be *positive, negative, or neutral*.

Notes

- Exhibits in which facilitators interact with and guide visitors **should NOT** include the facilitator as a participant for emotional analysis.

Code Name	Code Description
E_Positive Affect	<p>General: Positive expression towards the experience. This includes positive reactions to the experience, positive reactions to others within context of experience, positive body language/noises, and positive laughter (e.g. amused laughter or laughter indicating enjoyment/joy).</p> <p>Keywords: happy, joyful, supportive, positive</p> <p>Specifics (_____):</p> <ul style="list-style-type: none"> ● <i>Positive reactions to the experience:</i> ● <i>Positive reactions to others within context of experience:</i> ● <i>Positive body language/noises:</i>
E_Neutral	<p>General: Not expressing any positive or negative emotional response, although there might be energy in the expression (e.g. “Look at that!” said with energy is not necessarily positive or negative). This includes emotional responses that do not relate to the exhibit experience, interjectional comments (regardless of tone), conducting (i.e. telling others what to do), curiosity, observation, apologizing, and non-positive laughter (e.g. spoken "ha's"; laughter associated with negative or neutral comments: "oh no"; shy or nervous laughter (e.g. laughs, says maybe)).</p> <p>Keywords: neutral, not positive or negative</p> <p>Specifics (_____):</p> <ul style="list-style-type: none"> ● <i>Interjectional comments (regardless of tone):</i> ● <i>Conducting:</i> ● <i>Curiosity:</i> ● <i>Observation:</i> ● <i>Apologizing:</i>
E_Negative Affect	<p>General: Negative expression towards the experience. This includes negative reactions to the experience, negative reactions to others within context of experience, and negative body language/noises. This does <i>not</i> include conducting action (telling others what to do, e.g. “Stop that”), as conducting is more directional than emotional.</p> <p>Keywords: negative, unhappy, sad, angry, disappointed, disgruntled, mean</p> <p>Specifics (_____):</p> <ul style="list-style-type: none"> ● <i>Negative reactions to the experience:</i> ● <i>Negative reactions to others within context of experience:</i>

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| | <ul style="list-style-type: none">• <i>Negative body language/noises:</i> |
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