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Visitors and alignment: actor-network theory and the ontology of informal science institutions

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ABSTRACT

As informal science institutions (ISIs) play a larger role in science education, there is an increased need to research and understand how society identifies the brand of each institution. In this study, I apply actor-network theory (ANT) as a way to view the actors within and outside an ISI and define visitors' understandings about the institution. The practice of applying ANT explores the webs of the social and natural worlds and describes the relationships that occur. For the purpose of this paper, a zoo served as the example institution. Even though the example in this study is a zoo, the conclusions and discussion focus on how ANT may be used in a similar way across museums to define visitor knowledge of the institution. ANT may be applied by any institution to define its self-identity and tell the story of how the institution is viewed by visitors.

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Introduction

Informal science institutions (ISIs) of the twenty-first century are being pushed to communicate science in a way that increases science literacy (Christensen et al. 2015; Hine and Medvecky 2015; Pompea and Hawkins 2002). In order to achieve this goal, ISIs should have an enhanced understanding of the visitor perspective (Falk and Dierking 2012). By reaching out to visitors and understanding visitor perspectives, ISIs can increase the success of exhibit design, education, outreach, etc. Research has been completed over the last 30 years to determine why people visit ISIs (Falk et al. 2007; Falk, Moussouri, and Coulson 1998) and the influence of prior science knowledge (Davis, Horn, and Sherin 2013; Falk and Adelman 2013), but research has not considered the perspective the visitor holds of the institution. Therefore, ISIs should define their ontological representation and consider how the visitor views the mission, aims, and responsibilities of the institution.

As ISIs play a larger role in science education, there is an increased need to research and understand how society identifies the brand of each institution. This may seem like an unimportant and fastidious point, because research has and is focusing on the ability of institutions to make a difference in the science knowledge of visitors. However, ascertaining if the knowledge people have about an ISI is in alignment with the institution's identity

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is vital, because knowledge is a strong determinant of what learners believe is important or relevant and influences what people learn (Glaser 1993; Glaser and DeCorte 1992). By taking into account the idea that knowledge is a determinant of learning, then the knowledge people have of the institution will determine how easily they will accept or learn the educational message of the institution. If an ISI is branded by the visitor as a place of and where science occurs, then they will be more likely to accept the science education message.

In order to explain the importance of the public's knowledge of an ISI, I borrow the term brand awareness from consumer behavior research. The brand in this case is the ISI and the consumers are the visitors. Brand awareness is how easy it is for a person to remember the brand. An important aspect of brand awareness is related to brand image or the strong association between the brand and memory. When people see a brand in a favorable way, the brand is perceived with a positive attitude and the brand has a positive effect on the consumer (Keller 1993). Once people know a brand, an institution will find it easier to attach associations to the brand because awareness is significantly correlated to a positive image of the brand (Schuiling and Kapferer 2004). Due to the relationships that consumers develop with a brand, the brand has the power to influence customer perceptions and behavioral outcomes (Fournier 1998; Fournier and Yao 1997). By applying the concept of brand awareness, an ISI can be seen as a brand that promotes science and science education and influences the perceptions and behaviors of visitors. Thus, visitors' knowledge of an ISI as a brand has the potential to influence what visitors learn during the visit. Knowledge has been shown to be a strong determinant of what learners believe is important or relevant and influences what learners remember (Alexander 1996). For example, if visitors view zoos as conservation organizations, they are more likely to remember the conservation message.

In this study, I apply actor-network theory (ANT) as a way to view the actors within and outside an ISI and define visitors' understandings about the institution. ANT views all interactions and relationships in the social and natural worlds as a web that continuously generates effects. Everything within and outside those relationships creates its own reality and form. The practice of applying ANT explores the webs of the social and natural worlds and describes the relationships that occur. ANT may be used to describe relationships and applied as a 'toolkit for telling interesting stories about, and interfering in, those relations' (Law 2009, 141). For the purpose of this paper, a zoo served as the example institution. Even though the example in this study is a zoo, ANT may be used in a similar way across ISIs to define visitor knowledge of the institution. ANT may be applied by any institution to define its self-identity and tell the story of how the institution is viewed by visitors.

Applying ANT

Even though studies have been completed to define what people learn during a zoo visit and what they remember, large gaps still remain in our understanding of how people characterize zoos. Therefore, this paper reports on the findings of a qualitative study in which students, ages 10–26, were interviewed about zoos. ANT was used as a theoretical and methodological lens to analyze the relationship between zoos self-identity and visitors' notions of zoos. ANT takes into account individuals, objects, and information and

attempts to understand their interactions within a network (Fox 2000; Latour 2005). The goals of this study were to (1) define the zoo-actor identity through the literature review, (2) identify enrolment, or the characteristics the visitor-actor attributed to the zoo-actor, and (3) determine the visitor-actor inscription of the zoo identity. By identifying the zoo-actor's self-described characteristics, I will identify the self-identified brand. Through enrolment and inscription, I will determine the alignment of the zoo's self-identified brand and the visitor-actor's brand awareness. It should be noted that, though ANT was originally used in the way described here, more recently ANT has taken into consideration the tenets of social practice as a strategy, instead of as a theory, to explain the interactions between the practices of the institution and the role of the artifacts (Adamides 2015; Hussenot and Missonier 2010; Whittington 2006). In the case of this study, ANT is being used in its original form as defined by Latour.

Zoos see themselves as an important component of conservation and conservation education worldwide. However, little is known about the relationship between the zoo identity and visitor perceptions. Previous research has sought to identify changes in conservation knowledge and behaviors after a zoo visit, but the zoo-visitor interface remains poorly understood. Because ANT pays attention to the actors and their relationships (Latour 2005), it was used to provide a robust description of the complexity of zoos, while at the same time identifying the human and nonhuman components.

ANT, which was developed in the 1980s and is also known as the sociology of translation, has its origins in the sociology of science (see Bingham and Thrift 2000) and is based on constructivism. ANT is not a description of something, but is a way to trace understanding of action (Bajde 2013). The actors are all the entities, human and nonhuman, that are part of reality (Bajde 2013; Callon and Muniesa 2005; Latour 2005; Law 2004). The links that occur between the actors form the network. ANT reflects the belief that a complex interweaving of interdependencies occurs among the actors inside and outside an institution. As the network evolves, it moves from a place of heterogeneity to an indistinguishable manifestation of relationships, in which the actors share similar ideas and reach a homogeneous relationship (Bajde 2013; Harman 2009). This notion shifts the idea of the zoo from a closed box (Elias 1970) to including the visitors as actors. This means that we may examine how human and nonhuman actors align and become standardized and encourage recognition of the zoo in conservation. By analyzing how the network emerges, who or what is involved in the network, and the viewpoints of the actors, the network may be understood in a way that allows the main actor to adjust the network.

ANT uses the concept of translation to demonstrate how reality is constructed with associations and alliances within the network. Networks are transformational and move from heterogeneous to homogeneous understanding. Translation occurs when actors within the network become more aligned with the focal actor, in this study the zoo (Law 1994; Steins, Röling, and Edwards 2000). Moreover, translation is a process of negotiating and renegotiating representations or phenomena so they behave in accordance with the network requirements. Callon (1984) described translation as building 'an actor-world from entities. It attaches characteristics to them and establishes more or less stable relationships between them. Translation is a definition and the delineation of a scenario' (25–26).

ANT relies on the actors, the networks, and the elements of translation to align. The networks are made up of animals, plants, institutions, people, places, and other abiotic and biotic factors. An examination of the network allows for identification of whom or what the network encompasses, emergence of the network, and how actors are enlisted into the viewpoint (Korsgaard 2011; Latour 1996). Below, I define the six steps that occur in the translation process and explain how each step relates to this study:

- (1) *Problematization* is the interest of the focal actor. This is the main actor's self-identity. For this study, the main actor, who drives all other beliefs, was the term zoo (Callon 1984). The focal actor, the zoo, and its network were defined by the literature review.
- (2) *Obligatory passage point* is a situation that must occur for all the actors in the network to share the same network. Actors must pass through this point so that the attributes of the focal actor are recognized (Callon 1984). The obligatory passage point for this study was a zoo visit.
- (3) *Interessement* is the process of convincing the other actors in the network to accept the identity put forth by the focal actor (Callon 1984). For this study, interessement was not studied, but may be advertising, education programs, exhibits, signage, websites, etc.
- (4) *Enrolment* is when the actors in the network accept the identity of the focal actor as it has been put forth (Verschoor 1997). This study defined the attributes that network actors (visitors) viewed as a part of the zoo identity.
- (5) *Inscription* is when the identity of the focal actor becomes a part of the network actors' view of the focal actor even in the absence of the focal actor (Mouritsen, Larsen, and Bukh 2001). In this study, inscription was the interpretation the visitor-actor had after visiting a zoo(s).
- (6) *Irreversibility* is the point at which the network actors are so entrenched in their beliefs about the focal actor that it is impossible for the network actors to entertain other viewpoints (Walsham 1997). This study did not address the depth or entrenchment of the beliefs.

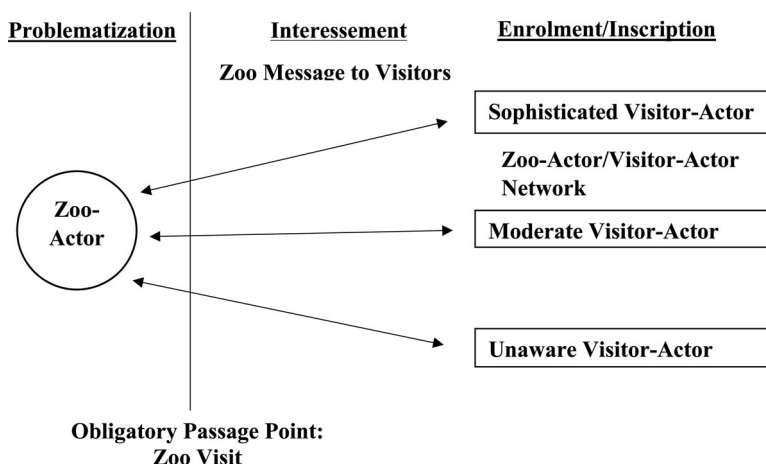


Figure 1. Process of translation within the zoo-actor/visitor-actor network.

Figure 1 is a visual representation of the process of translation as it relates to this study. Translation begins with the public persona the zoo-actor places in the public domain. The zoo-actor then proceeds through enrolment and inscription as they assimilate their knowledge of the term zoo and become a part of the zoo-actor network. The arrows on the figure indicate the bi-directionality of enrolment and inscription. In other words, as the visitors become more aware of the zoo as they interact within the network. Since the processes of translation permeate the network, this study focused, for clarity, on a single actor as a point of reference and the patterns defined by the collective. In this study, zoo visitors were the primary point of reference and the participants in the study were the collective zoo visitors. The focal actor was the zoo and the study focused on the inscription stage of translation to determine if the visitor-actor had inscribed the identity of the zoo-actor. The literature review was used to define the characteristics of the zoo-actor.

Literature review

Learning science in informal environments

The past 20 years has seen a marked growth of research interest in learning outside the classroom, e.g., informal learning, free-choice learning, out-of-classroom learning (Bevan et al. 2010; Falk and Dierking 2010; National Research Council 2009; Phillips, Finkelstein, and Wever-Frerichs 2007). This is particularly evident in the research on learning in ISIs and its influence on visitors (Bell et al. 2009; Borun, Chambers, and Cleghorn 1996; Dierking and Falk 1994; Fadigan and Hammrich 2004; Leister et al. 2015). The enthusiasm for the potential to learn outside the classroom has prompted the National Science Teachers Association (NSTA) to identify ISIs as playing a critical role in science learning for preK-12 students and adults (NSTA 2016).

The educational practices implemented in ISIs invariably rest upon the belief that science learning occurs outside the classroom (Falk and Dierking 2010). The assumptions are based on the idea that people visit an ISI with a learning agenda, will learn from their experiences during a visit, and construct new knowledge from prior knowledge. From this perspective, knowledge is conceived of as constructed over time, i.e., constructivism (Vygotsky 1980). Knowledge is internally represented in the mind of the visitor and the role of the ISI is to add to or reconstruct that knowledge. Implicit within this idea of knowledge and learning is the assumption that learning occurs over time and previous knowledge is an important basis for future learning. These are important assumptions as institutions move their visitors through the inscription stage of translation. In other words, institutions must understand the philosophical, social, and cultural perspectives that their audience has of the institution, before the institution may successfully change visitor perspectives.

The assumption that people visit these organizations with learning in mind has been described by Smith (2015) as the *learning paradigm*. Some studies support the notion that ISI visitors have an education agenda (Falk et al. 2007; Idema and Patrick 2016). However, a study completed by Roe and McConney (2015) questions this finding for zoos. During their mixed-methods study, 540 zoo visitor interviews were analyzed and 72% of the visitors stated they visited the zoo with a learning agenda. On the surface,

this seems to support the notion that zoo visitors have an educational agenda, but when education staff were interviewed they did not believe that zoo visitors attended with education or learning in mind. Additionally, Roe and McConney found that the interviews completed by the zoos may not have been well articulated.

Moreover, Packer and Ballantyne (2002) found that visitors' reasons for visiting an institution are related to the type of institution, which they visit. For example, visitors to aquariums are mostly interested in the recreational or entertainment aspects, while museum visitors were more interested in the learning aspects of the visit. Even though visitors may think of ISIs as places for entertainment, education and entertainment may be melded to provide visitors with an experience that addresses both. In Packer and Ballantyne's study, the aquarium visitors were more likely to see opportunities to learn during the visit than visitors to museums. Although education is an accepted part of the zoo mission statement (Patrick, Matthews, Ayers, et al. 2007; Patrick, Matthews, Tunnicliffe et al. 2007) it may or may not be the main reason people visit zoos (Roe and McConney 2015; Smith 2015). In fact in the case of zoos, the visit may be similar to the aquarium visit, i.e., visiting for fun, to see animals, and spend time with family; therefore, the zoo must understand the prior knowledge of the visitor and their notions about the zoo.

The zoo-actor

A zoological park, or zoo, is defined by Merriam-Webster and Oxford Dictionaries as a place where many types of animals are kept and exhibited for public view. Norton et al. (1995) define zoos as a 'professionally managed zoological institution accredited by the American Zoo and Aquarium Association and having a collection of living animals used for conservation, scientific studies, public education and public display' (358). The AZA (2016) defines the term zoo as:

a permanent institution which owns and maintains wildlife, under the direction of a professional staff, provides its animals with appropriate care and exhibits them in an aesthetic manner to the public on a regular basis. The institution, division, or section shall further be defined as having as their primary mission the exhibition, conservation, and preservation of the earth's fauna in an educational and scientific manner. (3)

Initially, zoos were considered by their owners as a place for the public to see animals, but they have evolved drastically since the 1820s (Conway 2003; Rabb 2004). This narrow focus for zoos changed in 1929 when the Bronx Zoo opened its education department (Schwammer 2001) and the idea spread that zoos could educate the public (Baratay and Hardouin-Fugier 2002). However, education was still not recognized as the main justification for their existence. During the 1960s, in addition to places of fun and family recreation, zoos saw themselves as responsible for education, research, and conservation (Nichols 1996). In the 1970s, rising concerns about ecological degradation caused zoos to declare conservation their central role (Hancocks 2001). Zoo professionals began conservation programs and the AZA maintained that conservation had become its highest priority (Hancocks 2001). At this time education was moving to the forefront as a role of zoos and they were expected to educate the public. The first major European zoos to develop educational programs were the London Zoo in 1958 and Frankfurt Zoo in 1960

(Schwammer 2001). Now, nearly all zoos in the U.S.A., Europe, and Australia, including small zoos, have Education Departments (Heimlich 1996; Walker 1991) and education as a focus.

In 2007, research was completed which defined the zoo-actor through its mission statements and journal articles; therefore, I will refrain from reevaluating the role of zoos through their mission statements and articles that were published prior to 2007 (e.g., Patrick, Matthews, Ayers et al. 2007; Patrick, Matthews, Tunnicliffe et al. 2007). In my previous research, I determined that zoos defined themselves through their mission statements as places of conservation, education, recreation, and research. Additionally, they published a review of the literature which in 2007 indicated the roles and purposes of zoos as breeding and reintroduction programs, changing visitor behavior and attitudes, conservation, entertainment, recreation, research, exhibiting animals for the public, inspiring conservation action, and instilling care for animals. The findings from the literature prior to 2007 support the notion that zoos viewed their roles as conservation, education, and research.

In 2011, Carr and Cohen analyzed 54 zoo website homepages from around the world and determined that zoos were positioning themselves as places of conservation, education, and recreation. Their findings showed that a weak correlation existed between the purpose of conservation and the conservation role zoos relayed via their websites. Instead, their message conveyed their purpose most strongly as providing recreation.

Within the literature, zoos are shown to be scripting a variety of roles, such as conservation, conservation education, recreation, and research. The literature demonstrates that zoos, far from simply displaying animals, are actively constructing interactions among biotic and abiotic factors. A combination of the literature and mission statements led to the zoo-actor characteristics that are shown in Table 1. The zoo-actor included 14 characteristics that I have placed into 3 categories: *abiotic*, *biotic*, and *depictive*. Abiotic characteristics included the zoo facilities and exhibits and their contents, but excluded animals, while the biotic characteristics included animals, plants, the visiting public, and staff. The depictive characteristics were classificatory topics that may not be accurately grouped as biotic or abiotic factors. These characteristics illustrated the intangibles of the institution, because they were difficult to value and exist only in connection to the biotic and abiotic factors that occur at the zoo. The depictive characteristics were administration, aesthetics, animal care, conservation/preservation, education, naturalistic, recreation, and research. Based on these findings, the reality is that the actor-network is a series of complex processes. Such processes can be characterized as the construction of knowledge, in which the assemblage of actors situated both inside and outside the zoo determine the actual construction of that knowledge. This literature is not a definitive look at the zoo-actor, but uses the literature as a reference point for comparing the views of the visitor-actor with the zoo-actor.

Methodology

In order to clarify the enrolment and inscription steps of translation that occurred among zoo visitors, a convenience sample of 857 students completed a free-listing and a concept map and 40 semi-structured interviews were executed. The research aimed at collecting a wide range of data from across a variety of age groups. During the free-listing, participants

Table 1. Attributes of the zoo-actor and visitor-actor.

Zoo-actor	Visitor-actor		
	Unaware actor (22%)	Moderate actor (41%)	Sophisticated actor (37%)
<i>Biotic</i>			
• Animals • Plants • The public (visitors and non-visitors) • Staff	• Animals (named) • Animal characteristics • Visitors (child, family, friend, teacher) • Staff (security, tour guide, tram driver, volunteer, zookeeper)	• Animals (named) • Animal characteristics • Visitors (child, family, friend, teacher) • Staff (tour guide, volunteer, zookeeper) • Plants (as food, named)	• Animals (named) • Animal characteristics • Visitors (child, family, friend, teacher) • Staff (volunteer, zookeeper) • Animal adaptations and behaviors • Plants (as food, named)
<i>Abiotic</i>			
• Exhibits and their contents (except animals and plants) • Facilities excluding exhibits	• Exhibits • Bathroom • Front entrance • Gift shops • Petting zoo • Playground • Restaurants (drinks, food) • Rides (gondola, rollercoaster, zip line) • Transportation (bus, tram, train) • Cages • Rocks/soil/water • Tickets	• Exhibits • Bathroom • Front entrance • Gift shops • Petting zoo • Playground • Restaurants (drinks, food) • Rides (gondola, rollercoaster, zip line) • Transportation (bus, tram, train) • Habitats/ecosystems exhibited • Tickets • Cameras/pictures	• Exhibits • Bathroom • Front entrance • Gift shops • Petting zoo • Playground • Restaurants (drinks, food) • Rides (zip line) • Transportation (bus, tram, train) • Habitats/ecosystems exhibited • Habitats/ecosystems of organisms outside the zoo • Signage • Cameras/pictures

Depictive

- | | | | |
|--|--|---|---|
| <ul style="list-style-type: none"> • Administration (finances, funding) • Aesthetic • Animal care • Conservation/preservation (breeding programs, rehabilitation, reintroduction programs, species survival plan) • Education (understanding conservation, understanding the interrelationship between wildlife and environments, understanding our place within the natural world, promote awareness and learning of conservation, change visitor behavior, inspire conservation action and attitudes, instill care) • Naturalistic • Recreation (fun) • Research | <ul style="list-style-type: none"> • Beautiful • Feeding animals • Size (large, small) • Smells • Sounds (loud, sounds of animals and people) • Walking • Animal care • Education (learn, new information, field trip) • Fun/entertaining • Watch animals • Natural/naturalistic (real) • Crowded • Safe/security • Money (entrance fee, purchasing items, price, expensive) • Weather (hot, cold, raining) | <ul style="list-style-type: none"> • Beautiful • Feeding animals • Size (large, small) • Smells • Sounds (loud, sounds of animals and people) • Walking • Animal care • Education (learn, new information, field trip) • Fun/entertaining • Watch animals • Natural/naturalistic (real) • Crowded • Safe/security • Money (entrance fee, purchasing items, price, expensive) • Endangered/extinct • Help save animals • Weather (hot, cold, raining) | <ul style="list-style-type: none"> • Beautiful • Feeding animals • Size (large, small) • Smells • Sounds (loud, sounds of animals and people) • Walking • Animal care • Education (learn, new information, field trip) • Fun/entertaining • Watch animals • Natural/naturalistic (real) • Breeding programs • Conservation (local, international, national) • Endangered/extinct • Giving money to save animals • Help save animals • Recycling • Save energy • Sponsoring zoo animals • Research |
|--|--|---|---|

Note: $N = 857$ participants.

were asked to state if they had visited a zoo, since this was a requirement for consideration as a visitor-actor. All of the participants in this study had visited a zoo prior to the study. Students were not asked to identify which zoo(s) they had visited, but the study took place in North Carolina (NC), U.S.A. which is the location of the North Carolina Zoological Park (NCZP). Moreover, the secondary student participants had participated in a field trip to the NCZP within one school year of the study. The convenience sample of 857 students were enrolled in institutions in North Carolina (NC), U.S.A. and the sample consisted of: (1) 260 middle level (10–12 year olds) art students at a rural, coastal school, (2) 278 middle level (10–12 year olds) science students at a suburban school near the mountains, (3) 234 secondary science students (13–18 years old), and (4) 85 pre-service science teachers (21–26 years old) enrolled in a small, suburban liberal arts college. The research aimed at collecting a wide range of opinions across a variety of age groups. However, the study did not focus on adults over the age of 26, because this was a convenience sample. The sample of 10 students from each group was chosen at random by the researcher.

Data collection

During the free-listing which was completed in class, participants were provided a blank piece of paper and three minutes to write down all the words they could think of when they were given the term 'zoo' (Wagner, Valencia, and Elejabarrieta 1996). Because free-listing is not an exhaustive test of the contents of the mind, but rather a sampling of concepts, one week after participants completed the free-listing, they were asked to draw a concept map using the term 'zoo' (Kinchin, Hay, and Adams 2000; Mintzes, Wandersee, and Novak 2001). Participants were given as much time as needed to draw the zoo concept map, but all participants had completed the map within 15 minutes. Prior to completing the concept map, the researcher showed students examples of concept maps and completed an example concept map with the class. Concept maps were chosen because they reveal the experiences, perceptions, understandings, and beliefs and biases of the participant and illustrate their organization of ideas (Jonassen, Beissner, and Yacci 1993; Lawson 1994; Novak 1991; Wiles et al. 1994). Moreover, the concepts in a map are represented in a hierarchical fashion with the most inclusive closest to the map term (zoo) and the more specific concepts further out from the map term. The free-listing and concept mapping activity provided a look at the concepts and sub-concepts that participants related to the zoo. The resulting data were a visual of the way participants understood the relationship between the main concept 'zoo' and the sub-concepts they related to 'zoo'.

One week after the concept map was completed, 10 participants (all who were asked agreed) from each age group were randomly chosen and interviewed. This resulted in 40 total interviews that lasted from 15 to 25 minutes. The open-ended interviews (Patton 1990) were digitally recorded and completed by the researcher in the libraries of the schools and in a coffee shop near campus for the college participants. The interviewer presented each participant with an 8.5" × 11" piece of cardstock with the term zoo printed in large font in the middle. Participants were asked to talk about what the term meant to them. Additionally, they were asked the following: (1) Tell me about your visit(s) to the zoo. (2) What do you remember seeing? (2) Tell me what you know about zoos. (3) Why

are zoos important? (4) What do you believe to be the role of (reason for) zoos? (5) What else do you know about zoos that you have not told me? As participants answered the questions, the interviewer would ask the participant 'Can you tell me more about that?' This open-ended questioning technique was used to encourage interviewees to elaborate on their thoughts and express their perspectives. Interviews were conducted in person and recorded. The recordings were transcribed and reviewed by the interviewee before being used for analysis.

Data analysis

In order to define the view of the participants as a visitor-actor, the data were aggregated. By separating the data into age or grade and comparing, the translation process would be lost as ANT focuses on the patterns defined by the collective not the individual. The process of interpreting the wordlists, concept maps, and interviews allowed for defining the enrolment and inscription steps of translation and a better understanding of the actor-network (Verschoor 1997).

For each participant, the free-listing words were placed in an Excel file in the order in which they were listed so that a record could be kept of the terms used and the order (Bernard 2006). The data were analyzed using an informant by item matrices to determine the frequency of occurrence and the order of the term's occurrence (Robbins and Nolan 1997; Smith 1993; Smith and Borgatti 1997). Terms most often used were considered to be most closely associated with the focal actor (the zoo) and the network. The concept maps were analyzed by a visualization method which generates data by looking at the maps and identifying topics or categories that relate to the main concept (Rebich and Gautier 2005). Similar to the free-listing, the categories were placed in an Excel file. The interviews were analyzed using a narrative strategy and visual maps were designed to analyze the data (Ferdinand and Williams 2013; Langley 1999). Nvivo a program which can be used to analyze, classify, and sort interviews, was used to record participants' thoughts about zoos and clarify the links that existed within the networks. Once the analysis of the interviews was completed, the data were compared to the data from the free-listing and concept maps to build a visual of the visitor-actor network.

Results

The goal of this study was to identify enrolment, or the characteristics the visitor-actor attributed to the zoo-actor, and the inscription of the zoo identity. The data presented in Table 1 represents the elements of the visitor-actor network and the alignment of the elements with the zoo-actor. After reviewing the data, three visitor-actor identities were revealed with each visitor-actor representing various alignments with the zoo-actor identity. The three identities indicate the type of inscription reached by the visitor. As shown in Table 1, the three identities were the *unaware visitor-actor*, the *moderate visitor-actor*, and the *sophisticated visitor-actor*. The identities were determined based on the characteristics the participant mentioned in relation to the zoo-actor. The characteristics in the clear boxes were mentioned by all of the participants, while the shaded boxes represent characteristics that were specifically mentioned by that visitor-actor identity. For example, there may be overlaps in the characteristics across the unaware and

moderate visitor-actors that were not mentioned by the sophisticated actor. The participants may not have mentioned all of the characteristics within the identity. However, to be placed in a specific identity they must have mentioned the characteristics that determined that identity. For example, to be included in the sophisticated visitor-actor they had to mention conservation. All of the visitor-actors mentioned characteristics from the three categories that related to the zoo-actor identity: abiotic, biotic, and depictive.

Unaware visitor-actor

The unaware visitor-actor comprised 22% of the participants. Even though the unaware visitor-actor mentioned characteristics of all three of the zoo-actor categories, this group was the least aligned with the zoo-actor network. The unaware visitor-actor was the only group to refer to the exhibits as cages; however, these actors also used the term exhibit and stated the exhibits were naturalistic. Moreover, this group of visitor-actors did not mention plants, research, and conservation and did not understand the role of zoos in conservation. These participants focused on people, physical features of the exhibits, seeing animals, and the cost of the visit. The following examples were taken from the interviews and represent the unaware visitor-actor's network:

While we were there we got ice cream. I think I got a corndog when I was there. There were a lot of people. It was really busy and we had to wait to ride the shuttle thing. I like to eat food while I am there and see the animals. (Mack, male, 16)

It was when I went back to Mexico and my Aunt was like do you want to go? It was like a treat and it was fun. We went with friends and family. We had a lot of fun. Walk around. Look at the different sites ... gift shops and all that. They [zoos] are a little boring if you go alone. Cool gift shops. (Consuela, female, 17)

Went with my girlfriend. She likes animals. Food was expensive and it costs a lot to get in. Gift shop was cool. They had a nice variety of stuff to buy. (Mike, male, 21)

Consequently, the unaware visitor-actor focused mainly on the zoo as a place to see animals, 'hang-out' with family and friends, and have fun. They were concerned with the tangibles or biotic and abiotic factors they could see during the visit.

Moderate visitor-actor

Even though the moderate visitor-actor, who made up 41% of the participants, mentioned nearly the same characteristics as the unaware visitor-actor, the moderate visitor-actor additionally included animal care, cameras/pictures, endangered/extinct, habitats/ecosystems at the zoo, help save animals, and plants. They did not mention cages in relation to the exhibits. The moderate visitor-actor's network presented as more closely aligned with the zoo-actor network. The moderate visitor-actor included information about endangered/extinct species and represented a better understanding of the role of zoos in conservation; however, they did not use the word 'conservation' or mention specific ways in which zoos were involved in conservation efforts. These participants stated that the zoo was saving or assisting in saving animals. Moreover, they viewed zoos as a place to learn or find out new information. The following quotes from participants are characteristic of the moderate visitor-actor:

I think zoos are fun to go to especially with little kids. Looking at the wonder on their faces. They really learn a lot about animals. People really learn a lot about animals. They learn where they are from, what they eat, what their habitats are. (Lillian, female, 25)

A zoo is a place where we hold animals in captivity to be seen in almost their real life settings and they're safe and if they're endangered they're safe. (Tommy, male, 18)

They save endangered animals. Like from the wild probably. (Latoya, female, 13)

The greatest difference between the unaware visitor-actor and the moderate visitor-actor was the realization that zoos are more than a fun place to go. Zoos were seen as having a role in learning and a responsibility to the welfare and future of its organisms.

Sophisticated visitor-actor

The sophisticated visitor-actor was most closely aligned with the zoo-actor and included 37% of the participants. In addition to some of the characteristics mentioned by the first two types of visitor-actors, sophisticated visitor-actors put more emphasis on animal adaptations and behaviors, related the ecosystems and habitats to organisms outside the zoo, and mentioned the zoos' conservation and research-related activities. This visitor-actor identity accepts zoos as responsible for conservation action, such as breeding programs, local, national, and international programs to protect organisms, research programs and recycling.

They will ... they breed ... they like breed the 2 red wolves and when the pups do come out they'll let them live with their mom for a little while. Then they'll reintroduce them out into the wild so they can live in the wild. (Tierra, female, 15)

Zoos like take in ... they take in ... like in Japan or something like that and they rescued a little panda bear and they kept it there and now she's doing really good. So I think zoos care for the animals really well. (Isabel, female, 13)

Let's say that the jungle was been disappearing because of humans or buildings or houses or something, so they take animals and they put them in places similar to where they're used to living so they can keep growing. If an animal is on the endangered species list, they will get two. They will like breed them and introduce the children into the wild. They are getting the red wolf off the endangered species list. (Tyrone, male, 23)

The sophisticated visitor-actor characterization of the network more closely aligned with the zoo-actor characteristics. Zoos were seen as catalysts for conservation action as this group tended to be more responsive to the idea that zoos are responsible for conservation.

Discussion

The goals of this study were to (1) define the zoo-actor identity through the literature review, (2) identify enrolment, or the characteristics the visitor-actor attributed to the zoo-actor, and (3) determine the visitor-actor inscription of the zoo-actor identity. The results of the literature review determined that the zoo-actor identity consisted of 14 characteristics that fit into 3 categories: abiotic, biotic, and depictive. These characteristics were used to establish visitor-actor enrolment and inscription in the zoo-actor network.

The zoo-actor sees itself as a place for people to engage in recreation, learn about conservation and biodiversity, and see organisms. The zoo-actor defines itself as a place for conservation action, preservation, and research. Additionally, they focus on administration, aesthetics, animal care, and naturalistic design.

The enrolment stage of translation in the zoo-actor network strongly supports that all visitors view the zoo-actor as a place to see animals. This result should not be surprising as that is the definition of zoo; however, research has not presented a comprehensive view of the additional characteristics visitors attribute to zoos. In fact, the results demonstrate that the visitor-actor has reached the enrolment stage of translation. The visitor-actor is aware of the zoo-actor and does attribute specific characteristics to the zoo-actor. All of the participants mentioned characteristics within the abiotic, biotic, and depictive categories. However, a closer look at the characteristics revealed that the visitor-actor had differing types of inscription.

Inscription occurred when the zoo-actor identity became a part of the visitor-actor's view of the zoo. While all of the visitors reached the enrolment stage and attributed zoo-actor qualities to the network, the results of this study show that three identities of inscription existed among the participants. The three visitor-actor identities recognized various attributes of the zoo-actor. Unaware visitor-actor is the least aligned with the zoo-actor network. The most aligned is the sophisticated visitor-actor, while the moderate visitor-actor is aware it does not attribute conservation action and research to the zoo-actor. The unaware visitor-actor viewed the zoo solely from a social perspective and related the visit to seeing animals: 'My friend likes animals so we spent a lot of time watching the animals' (Serina, female, 15). The moderate actor had some idea about conservation, but did not describe the depth at which the zoo-actor was involved in conservation: 'Zoos protect some animals. I guess saving animal stuff' (Franklin, male, 16). The sophisticated actor had a developed understanding of the relationship of conservation within the zoo-actor network. For example, the sophisticated actor described ways in which the zoo-actor was involved in conservation inside and/or outside the zoo 'they take plants from ... like whenever somebody's taking stuff ... they can take the plants from there without killing them and put them in a conservation or wildlife area' (Tila, female, 14).

The findings are not meant to imply that one visitor-actor identity is better than another. Instead, these actor identities should be seen in the spirit of ANT. These identities, even though different, should not be discounted or seen as levels of inscription. These identities should be seen as a starting point for understanding and reaching the audience. For example, the unaware visitor-actor has a social and affective/emotive relationship with the zoo-actor. The zoo-actor should use the information about the visitor-actor to distinguish successful approaches to leveraging the importance of social interactions and engaging visitors in affective/emotive-based learning opportunities that connect visitors to the organization.

One of the promises of zoo mission statements is that zoos will educate the public about conservation (Patrick, Matthews, Ayers et al. 2007; Patrick, Matthews, Tunnicliffe et al. 2007). In principle, the mission should lead to a more homogeneous zoo-visitor actor network. This may be the case. Even though 22% of the participants did not mention conservation in relation to zoos, 41% mentioned conservation related terms and 37% described ways in which zoos were involved in conservation. This should be a relief to the zoo-actor as they are under pressure to become an educational resource

and bring biological conservation to the forefront of educational programs. However, this is not cause to celebrate, because the majority of visitor-actors do not have a deep understanding of the relationship between zoos and conservation. Under the aegis of conservation education zoos have the potential to shape public opinion, encourage empathetic attitudes toward wildlife, and educate the public about ecology, evolution, and wild animals.

Past and recent research have differing findings concerning if people visit ISIs with an education agenda (Falk et al. 2007; Idema and Patrick 2016; Packer and Ballantyne 2002; Roe and McConney 2015). The data from this study showed that when participants were asked about zoos 60% of the 857 participants ($n = 514$) mentioned an education related term (education, learning, learn, new information). This finding is interesting, but should not be interpreted as a reason for visiting. This finding indicates that zoos are seen by the visitor as a place to learn during the visit, which supports the findings of Packer and Ballantyne (2002, 2010).

Even though the results of this study suggest that the zoo-actors' relative power is essential in influencing the normative beliefs of the visitor-actor, this study does not address the additional influences on participants' responses. This study determined that zoo visitors describe attributes of zoos that align with the ways in which zoos define themselves. However, this study did not determine the influences of prior knowledge, backgrounds, or interests in zoos. Further studies should focus on if non-visitors have similar notions about zoos, and if so, from what information do those ideas form? A follow up study should focus on non-visitor actors, because they are a part of the network and as such an understanding of their perspective is important.

Historically, zoos have been a place to display animals for human enjoyment. This brand awareness is consistent across all zoo visitors. Visitors are aware of the zoo brand and have a positive feeling about zoos as places to spend time with family and learn. Therefore, because zoo visitors see zoos in a positive way zoos should find it easier to attach conservation to the current brand awareness and change behaviors. For thousands of years, zoos have seen themselves as a place to view animals, while they have only in the last few hundred years been focused on conservation and education. Brand awareness takes time and should not be expected to happen quickly. The data indicate that zoos are moving in a positive direction. They may always be seen as recreational places, but this study shows that the ways in which people see zoos as a brand is changing. Similar to this study, Moss, Jensen, and Gusset (2015) found that when visitors were exposed to biodiversity interpretation at the zoo, they were more aware of biodiversity and conservation of biodiversity. The zoo-actor messages are getting through to the public. Visitors are beginning to recognize zoos as conservation and research entities and are developing a deeper understanding of the term zoo. All visitors may not have the same visitor-actor ideas when attributing characteristics to the zoo, but they are identifying characteristics of the zoo that are deeper than just a place for fun. Socially, zoos are changing their mantra from a place to see animals to conservation action, education, and research (Fraser and Wharton 2007). As these ideas become socially accepted norms and zoos move toward becoming cultural change agents, the ways in which people (visitors and non-visitors) view zoos will become more homogeneous with the way zoos view themselves.

Conclusions

This study was meant to be a testing ground and example for ANT as a methodology. The use of ANT as a way in which to determine the relationship between visitors and an ISI is significant. ANT offers an opportunity for all informal learning institutions to break outside their black box (Callon and Latour 1981) and define their institution and interpret the visitor. ANT should be an important part of the informal learning institution's tool kit. Understanding the ways in which visitors interpret and reflect the message of the institution is powerful. The convergence of ANT, informal institutions, and visitors as a framework of cultural patterns will allow a better understanding of the institutions' aftereffects on the social world and social space.

The zoo example indicates that ANT may be used to show that the relationship between the ISI and the visitor is significant. There are important reasons why ANT should be a part of the ISIs educational and theoretical toolkit. ISIs are places for social interactions and ANT is an important tool for better understanding what the ISI is and its consequences for the social world and social space of the visitor. The ISI's self-identified ontological role and the visitors' perception of that role can be analyzed without abandoning the importance of social and natural interactions. This raises the importance of visitor interpretation and ISI representation. ANT takes on the challenge of understanding the social perspective from the ISI and the visitor. ANT could aid ISIs in circumventing the limitations of the ontological assumptions of the ISI about their relationship with the visitor. By allowing the ISI to trace the multiple networks of visitors' beliefs, the ontological assumptions of the ISI can be revealed and empirically counted.

This study and the use of ANT provide a compelling and coherent structure to organizations that are interested in defining their audience. However, this study is not meant to be an end point. This study should mark the beginning of empirical and theoretical work in museum studies that focus on developing models of visitor-actors and understanding their characteristics. In particular, further research should clarify if these findings are valid across all institutions. This study was completed in a zoo, but should be applied in other institutions taking into account their goals and defining their visitor-actors.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Dr Patrick's research interests are in informal science education, preparing informal educators, and the influence of family culture and science knowledge on science learning.

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