One of the most attractive features of a space agency career is the autonomy and opportunity to work on interesting projects. This environment creates a motivated technical workforce, but it also limits the ability for HR managers to ensure that staff, both technical and project, are prepared for the future needs of the agency. For example, from an innovation perspective NASA’s technology management system assumes that technologists individually split their effort between research projects and mission-system developments. As a result, knowledge of mission needs directly informs R&D and vice versa. However, in practice individual technologists tend to focus on one or the other at particular points in their careers, severely limiting the assumed knowledge transfer mechanism (Szajnfarber, 2011). If HR managers hope to control aggregate workforce characteristics, there is a need for a better understanding of how management-level incentives drive individual behavior and how those incentives impact future organizational needs.

In the long run, this research seeks to create a discrete choice model to simulate these individual/management level dynamics. This paper focuses on the first step towards that goal: contextually examining the technical workforce at a NASA center and characterize them in terms of identities. Based on in-depth interviews with scientists and engineers, this paper develops a taxonomy of identities, which aims to capture the ways individuals make tradeoffs among different ways to their spend time. Our findings suggests that individuals can be broadly categorized as “explorer,” “exploiter,” or “bridger” and that the orientation for each category is influenced by how they value time, task content, and role. The results provide a good understanding of what could be measured in future research, in particular with regards to identifying ways in which aggregate workforce dynamics can, and cannot, be influenced. Future work will create a model-based environment in which to test these policies explicitly.

I. INTRODUCTION

It is widely accepted in the literature that both exploitation of old certainties and exploration of new knowledge are fundamental activities for organizations to achieve sustained performance (March, 1991). This combination of innovation and refinement is especially important for R&D organizations since exploration is not just an option but an essential part of their operations. Although there is a strong stream in the organizational literature dedicated to understanding how the exploration/exploitation balance can be attained, the focus has been predominantly structural and theoretical and it hasn’t looked carefully at the individual level.

A fair amount of the exploration and exploitation in knowledge-intense firms occurs at the individual level (Groysberg & Lee, 2009). Despite the importance of the role that professional, highly-trained employees play in R&D organizations, scholars haven’t paid enough attention to study how their preferences and behaviors affect organizational exploration- exploitation efforts. It is imperative to understand how these technical professionals -who are granted with considerable discretion- make decisions in terms of how to allocate their time between innovation and refinement. These decisions, over time, impact the distribution of knowledge and career progressions of the workforce, which for a knowledge organization and its HR management is important to monitor.

In this exploratory field study we focus on employee’s preferences with respect to exploration and exploitation types of activities. More specifically, we study the motives behind technical professionals’ preference for work on refining old technology, developing new one, both, or none (managerial type of activities). Engineers and scientists at a specific unit at a NASA center compose our sample. We group employees with similar preferences in archetypes or representations of identities “after which later recurrences are patterned” (Jackson, 2010). We found that motives behind employees’
preferences come from a sense of achievement or a sense of ownership and that the combination of these motives with the way people perceive time is what defines them as one of the three archetypes found: “explorers”, “exploiters”, or bridges. Although for the purpose of simplicity, archetypes are well defined, people may identify with one or more of them.

This research is the first step in an ongoing project that aims to identify the kinds of incentives that can be effective to specific archetypes in terms of exploration and exploitation efforts. In this stage of the research we explore employees’ preferences for different types of work so that we can formulate hypothesis to be tested in a future survey type of research. Our insights add to the scarce literature on individual ambidexterity, specifically with regards to R&D employees. With regards to the management practice, our contributions are especially helpful to technical managers and HR managers in staffing tasks and incentive design for highly trained workforce.

II. LITERATURE REVIEW

How organizations change and adapt to dynamic environments has been a central discussion in many areas of the management literature (Gersick, 1991; O’Reilly & Tushman, 2007) for the last half-century. More specifically, the question of how to manage the tensions between exploration and exploitation activities in organizations has become a key challenge to face if sustained performance is sought (Raisch, Birkinshaw, Probst, & Tushman, 2009). In his seminal work, March (1991) describes exploration in terms of experimentation and flexibility, and exploitation in terms of refinement and efficiency, among others. On the one hand, exploiting certainties can rapidly lead organizations to a stagnation state. On the other hand, solely exploring is too risky and expensive for organizations to become a sustainable practice. Thus, both exploration and exploitation are important for organization survival. This general conceptual distinction has been used in different research areas such as organizational learning (Garcia, Calantone, & Levine, 2003; Levinthal & March, 1993; March, 1991), technology management (Benner & Tushman, 2002; He & Wong, 2004), and organizational design (Duncan, 1976; Tushman & O Reilly, 1996), among others.

The importance of both exploration and exploitation for organizations’ performance is to some degree undisputed among researchers. Both are essential but different in nature (He & Wong, 2004), and they compete for limited organizational resources (March, 1991). Nevertheless, the need for simultaneous execution of exploration and exploitation, so-called ‘ambidexterity’ (Duncan, 1976; Tushman & O Reilly, 1996), and its management has been subject to greater debate in the last decades (Raisch et al., 2009). Despite the advancements in this area, questions and ambiguities remain. For example, Raish et al. (2009) identifies the following four central tensions in the literature: differentiation versus structural integration of exploration and exploitation; individual versus organizational ambidexterity; static (temporal sequencing) versus dynamic (simultaneous and continuous) ambidexterity; and internal versus external perspectives of ambidexterity.

The structural aspect of ambidexterity dominated the discussion in the literature after March’s (1991) work. Many scholars agreed with the idea that because exploration and exploitation are two fundamentally different activities, they must be carried out by different organizational units. For instance, Tushman & O’Reilly (2007) argue that exploration and exploitation should be pursued simultaneously in structurally separated and internally aligned units where these fundamentally different units need some “structural linking mechanism to leverage shared assets” (O’Reilly & Tushman, 2007). Advocates of this view have mainly added literature on structural coordination of exploration and exploitation.

From a different perspective on structural ambidexterity, Gibson & Birkinshaw (2004) suggest that ambidexterity is more sustainable and presents less coordination problems between subunits when a contextual ambidexterity is developed. Thus, ambidexterity is “best achieved not through structural, task or temporal separation, but by building a business unit context that encourages individuals to make their own judgments as to how best divide their time between the conflicting demands for alignment and adaptability” (Gibson & Birkinshaw, 2004). Their paper is only one of the few works that mention the importance of the individual dimension of ambidexterity.

1 For a comprehensive review of the literature on ambidexterity, see Raisch & Birkinshaw (2008).
Although Gibson & Birkinshaw (2004) focus was on contextual ambidexterity where individual employees could perform both exploration and exploitation, subsequent papers that also include an individual dimension merely concentrate on manager’s-level ambidexterity (Mom, van den Bosch, & Volberda, 2009; O’Reilly & Tushman, 2007; Smith & Tushman, 2005) with very few exceptions (Groysberg & Lee, 2009). All this disproportionate attention of the literature regarding structural and managerial aspects of exploration and exploitation is to some degree ironic considering that March’s (1991) iconic paper draw organizational conclusions from a model of individual and organizational learning. His work included two levels of analysis and a time dimension, which is precisely one of the key pieces still missing in the ambidexterity literature (Eisenhardt, Furr, & Bingham, 2010; Gupta, Smith, & Shalley, 2006; Raisch et al., 2009). More specifically, the aforementioned literature has neglected the role of employee-level ambidexterity (Groysberg & Lee, 2009; Mom et al., 2009). Hence, there is “...a need for theories that capture ambidexterity across multiple levels of analysis.” (Raisch et al., 2009)

At an aggregated level ambidexterity is theoretically possible through either structural separation –that is, a unit performing exploration and a different one performing exploitation- (Tushman & O’Reilly, 1996) or temporal sequencing –which involves going through periods of exploration followed by periods of exploitation and so on- (Brown & Eisenhardt, 1998). However, at an individual level structural separation is hardly distinguishable if at all possible. This leaves temporal sequencing as the one possible way in which individuals can perform both exploration and exploitation.

Employee-level ambidexterity is especially critical in R&D organizations where technical professionals enjoy plenty of discretion (Jain, Triandis, & Weick, 2010; Stern, 2004). “Since R&D typically requires highly specialized scientific and/or technical knowledge, it is almost inevitable that the management will delegate real decision authority to the researchers about what targets to pursue, what approaches to take, and how much resources to allocate to each step. This means that the management cannot intervene in the day-to-day operation of their R&D projects” (Owan & Nagaoka, 2011). Hence, this paradox of “managing the unmanageable” (Jain et al., 2010), especially in terms of personnel, becomes a big challenge for administrators. How do people with different organizational identities interact? How much do they follow formal rules? How do they respond to different incentives? Do some of them have more influence in decisions than others? The identification of these “organizationally relevant behaviors” (Gouldner, 1957) or identities becomes useful for both the literature and the R&D management practice.

There is a stream of literature that that aims to understand differences in technical professionals. In the late 50’s the terms “local” and “cosmopolitan” (Merton, 1957) became popular among scholars studying scientists and engineers in organizations. These two terms were first used to describe two distinct and opposed organizational identities (Gouldner, 1957). From the management perspective, organizations that only hire employees that are locally-oriented (high organizational loyalty and low expertise) will lack the ability and talent that will set them apart and make them competitive (Gouldner, 1957). This discussion also touches other managerial issues such as “varying incentive systems, differential emphasis on publication of research results, types of authority and supervision related to the professional need of autonomy, divergent and conflicting influence on work situations, assignments and research problem choices, budgets of time and money, kinds of compatible work groups, focus on performance, multiple career lines and commitments.” (Glaser, 1963)

The ‘dual ladder’ system emerged from the management practice as a response to the need for more suitable and rewarding career opportunities to keep technical professionals in their technical area. The technical ladder was intended to provide increased status and better salary -as the management ladder does- but it was also intended to offer more autonomy for individual research without the burden of administrative duties (Goldner & Ritti, 1967). One of the main assumption behind this reward system was that, without a technical ladder, engineers and scientists who wanted a better salary, status, or other desired aspirations, were ‘forced’ to pursue managerial positions at the expense of their technical talents (Allen & Katz, 1986). Another important assumption was that technologists value their profession over the organization where they work, and that the upward mobility in the organizational hierarchy is of less importance than greater autonomy and prestige in their specialties (Goldner & Ritti, 1967).

Although the term ‘technologists’ includes engineers and scientists, there are differences
between and within these two types of professionals that are important to acknowledge if an effective incentive system is to be designed. Goldner & Ritti (1967) showed that engineers have goals that align better with the management ladder than with the technical one. On these same lines but without differentiating scientists from engineers, Allen & Katz (1986) indicated that those preferring the technical ladder were more concerned with their professional reputation while those inclined towards management where more interested in organizational issues. One of the criticisms to the assumptions of the dual ladder that these authors identify is the impossibility of providing much individual freedom because most of the technical work cannot be done in isolation, and the technical ladder is not designed to reward groups but individuals. Scientists can work in isolation and come up with great scientific discoveries whereas engineering projects usually require a group effort.

In these bodies of literature (locals vs. cosmopolitans, dual ladder, scientists vs. engineers, etc.), the vast majority of their studies resulted from the formulation of hypotheses based on theory and then conducted statistical analyses to test it. In our research we take a different approach. We take an empirically based approach in which we aim understand employees preferences for exploratory and exploitative type of activities so that we can identify organizationally relevant identities of technical professionals. This research is part of a bigger project in which we will be formulating hypothesis and testing them statistically, just like in the local-cosmopolitan literature. But before being able to ask questions in a survey we need to know what variables can be measured and what kinds of questions will make sense for the specific technical professionals to answer.

If HR managers hope to control aggregate workforce characteristics, there is a need for a better understanding of how management-level incentives drive individual behavior and how those incentives impact future organizational needs.

III. DATA AND METHOD

The data was collected from face-to-face, semi-structured interviews with 25 scientists and engineers at a NASA center. Participants were selected from their membership in a particular business unit engaged in both R&D and project development (purposive sample). Interviewees ranged from relatively recently hired to senior employees, from managers to scientists, from bachelors to postdocs, and included people in different hierarchical levels.

The interviews were conducted around three topics: background and career progression, job characteristics and preferences, and incentives. Interviews lasted an average of 50 minutes. All except one interview were recorded, transcribed and then coded in the software Atlas.ti. Our basic datum unit is a quotation. Each quotation is interpreted and one or multiple codes are assigned. Codes are constantly compared in order to modify and/or improve the interpretation of the emerging concepts and core categories.

A random number was assigned to each interviewee as the identifier. When quoting, this identifier will be displayed in parenthesis so that readers can notice the variety of quoting sources and trace quotes from the same participant.

Grounded theory was used to inductively identify staff preference “archetypes” in the federal laboratory context. This paper presents some preliminary results in this theory building process. Quotes were be broken down in descriptive categories, then re-evaluated in terms of interrelationships and lastly subsumed into broad categories (Goulding, 2002). The result of this process is a set of staff-preference archetypes. Although we haven’t reached theoretical saturation yet, some preliminary results can be communicated at this stage. We will continue “selecting interviewees until they are saying nothing new about the concepts being explored” (Cutcliffe, 2000).

This stage of the research is qualitative and exploratory. Our objective is to find plausible relationships of variables -not testing theory with conclusive analyses- with the goal of guiding future research. Subsequent research will include larger sets of data that will make statistical analyses possible and relevant.

IV. ANALYSIS

This section presents a description of the NASA center from which our interviewees were sampled. This will provide context information about our sample. Following this section we present the analysis and discussion of our study.

Context: A NASA center

The center under study is responsible for activities including design, manufacturing,
integration, testing, and operations of spacecraft and instrumentation. For all this to happen, this center and NASA in general, relies on diverse and highly skilled human capital.

In terms of the organizational structure, this center groups its activities in a matrix-type structure where science divisions are the businesses (columns of the matrix) and the engineering divisions are the functions (rows of the matrix) (Figure 1). There are several other functional directorates supporting the different projects and missions developments at this center. At the specific level that we are analyzing, units are functionally structured but they operate on a projects-basis.

![Figure 1: Matrix structure](image)

The specific unit that we are focusing on contains a mix of activities and technical professionals that can be considered a representative of NASA’s operations where scientists and engineers work closely together to create new technology, improve existing technology and carry out mission-system developments. Each sub-unit included in this research is managed by one full-time manager and one professional who, theoretically, spend half time in management assignments and the other half in technical activities. There are also the “technologists” who in addition to their normal activities have to monitor technologies and promote internal research funding opportunities. Some engineers and scientists are also group-leads within the sub-units. Our interviewees include employees in each one of these roles as well as professionals up the organizational hierarchy and employees who have transferred to other units within the center.

In the context of NASA, scientists are the technical professionals who are part of the Science Directorate only. A PhD with a post doc in Physics who works in the Engineering Directorate is an engineer, not a scientist. Scientists are considered the customers because every research or flight project carried out by NASA must have a science objective.

“[A]ll of our technologies have to have relevance to science because that’s our major work here so you can’t just say: I have this great chip design that would make commercial television fabulous. That is completely irrelevant and would not be acceptable to what we are looking for.” (258)

While the NASA definition of what is considered a scientist or engineer is very particular to its organizational culture, the literature uses this distinction much more loosely (Allen, 1984). In this paper we use the science/engineer distinction only as background information about the employee’s education. In future research this information will be used as a control variable but for the purpose of this research, we will not build archetypes on the basis of an a priori classification but as a result of our in-depth analysis.

Managing an R&D organization like NASA is very challenging because of the inherent complications of government organizations and also because of the uncertainty around long-term technology investments. As one experienced employee explains:

“What we are doing is very different from a lot of engineering. A lot of engineering in companies, corporations that make things, is evolutionary. Each car is very much last year’s model with the headlights shape has changed a little bit. Every time we launch a satellite with an instrument that does a particular thing it’s expected that you wouldn’t even consider launching it unless it’s two or three times better or ten times better in some way than the previous measurement. So we are really really pushing technology so everything we do is very different each time and it’s what makes this place so interesting to work for but it’s also one of the frustrations because in planning the mission managers like to try to claim that this mission satellite development, this Observatory is very much like the previous one, it’s just a few minor changes but that is not true, it’s always doing things in a new way.” (391)

Living in ‘exploration mode’ may be the reason why some technical professionals work at NASA. However, at the organizational level this is a challenging state to manage in terms of planning, controlling and learning. In addition to this, managers need to control a distribution of employees with very different orientations.

“At [the center] we do many different things, conceptualize something and then we do research and development as well as flight projects. There are other NASA centers... [where] they do pure research, and they don’t care about flight projects so... on those centers you will probably find a lot more people who care only about the research and nothing else but here at [this center], because our focus is flight projects, you find that most...
people care about either research as well as flight projects or just flight projects. But because of that we are also kind of in a unique position in that we need to have both kinds of people because we’re not only trying to do the current flight projects but we need to win future flight missions as well and in order to win future flight missions we need to have the technologies for the future and you cannot really get there without research and development. So, at [this center] we need to have both.” (179)

In this research we aim to understand technical employees’ preferences to guide the design of management leavers to control the distribution of employees over time. In order to identify employees’ preferences for time allocation in different work activities we analyze the way people describe those activities and how they talk about their stated preferences. After this we group them by preferences, resulting in a set of archetypes that guide our discussion of possible incentives.

Code Analysis

The interviews addressed topics such as characteristic of the different types of work activities and personal preferences for them, career progression and aspirations, and preferred types of recognition, in addition to background information. Since the interviews were semi-structured, people had the chance to bring up other relevant topics for them. The flexibility of the interviews yielded rich understanding of the context and complexity of the interviewee’s personal perspectives but, at the same time, made the data processing much harder to present.

The way people describe the types of activities in which they may allocate time it’s almost never free from personal judgment. For example, when some people refer to working on flight missions they focus on how proud they are on having contributed to something that is in space right now while others focus on how tedious the flight project work is in terms of processes and paperwork.

...in some respects I think the flight project is more satisfying just because you have a beginning and an end, it’s a relatively short period of time, you can see an end product that is delivered. It’s producing something that’s useful that makes people happy... (951)

The annoying part is all the paperwork that you have to deal with for flight mission and all the, I would say, the bureaucratic things that you have to deal with ... (513)

In the first example, the interviewee highlights the satisfaction of producing something, delivering. The second example also refers to flight project work but what the participant emphasizes is the bureaucratic processes around this type of ideas. Interviewees were asked to describe activities and it was up to them to focus on positive, negative or comparative aspects of them.

Some people talk about how exciting it is to come up with a new idea and carry it out. Others get motivated about facilitating scientists and engineers to work on new technology and flight missions.

“The most favorite part of my job is to be able to do these amazing things like I can come up with a concept that is completely new but can have a huge impact for future NASA missions. To be able to carry out my idea is the best part. Once I can get some buy-in from funding people I can carry it out.” (179)

“...sometimes when you work for government institutions there is infrastructure there and bureaucracy that you have to kind of work around, there’s certainly loops that you have to jump through to get things done so I spend a lot of time trying to find what’s the most efficient way to do something, not just for me that I want to keep things efficient but for the people in my branch by helping them through that bureaucracy so they can really focus on the technical work.” (705)

Although there are probably infinite differences among technical employees, there are some commonalities that can help us create a typology of technical professionals. The first step to do this was to select quotations that would give some indication of motives behind preferences. Table 1 displays examples of quotations and their assigned codes. The complete set of codes was grouped in more general concepts (second order-themes) and aggregate dimensions can be seen in Figure 2.

![Figure 2: Structure of the code, themes and categories derived from interviews.](image-url)
Codes were classified by themes and the emergent themes that we found were role and task characteristics, and work context. Table 2 presents the theme descriptions and examples. Table 3 exhibits some quotation examples for each of the second-order theme.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role implications</td>
<td>Includes codes related to the effects of the role with respect to the task and the preferences for it.</td>
<td>Working on 'own work' and 'work on what you want' implies high personal investment in the task and autonomy over the task. Appreciating a high 'impact on deliverable' means that there is a preference for a role that implies personal investment and decision-making power over the task.</td>
</tr>
<tr>
<td>Task characteristics</td>
<td>Comprises codes that refer to attributes of task itself that make it preferable.</td>
<td>Some people appreciate working in the lab and 'working on something new' because the innovativeness of the task makes it unpredictable, surprising and exciting. Other people feel very stimulated when they are challenged to solve technical problems.</td>
</tr>
<tr>
<td>Task implications</td>
<td>Encompasses codes that refer to the consequences of carrying out the task.</td>
<td>Some people like the feeling of completing a task, delivering, seeing things fly. To 'enable' is a different example that can be consider a 'task implication' as well as a 'role characteristic'. As a task implication it means that some people feel rewarded when they help others take advantage of opportunities.</td>
</tr>
<tr>
<td>Role characteristics</td>
<td>Includes codes that allude to the importance of holding a position.</td>
<td>Some people enjoy being in a position where they actively interact with others. Some people do not care about their formal position in the organization (role) as long as they can keep working on the tasks that they enjoy. In this last case, people prefer to work on certain activities because of the task characteristics, not the role characteristics.</td>
</tr>
</tbody>
</table>

Table 2: Theme description and examples

We observe that role implications and task characteristics feed a sense of ownership. When “owning”, the task is malleable and personal and the role is active and powerful. Task implications and role characteristics contribute to a different feeling: the sense of accomplishment. When “accomplishing”, there is a pride in participation and completion. Accomplishing is an event that brings a sense of satisfaction. Role characteristics, or the importance of the position, feed a sense of accomplishment. In this case the task overlaps the role, that is, things are accomplished because there are roles that enable that process.

Now that we identified differences in preferences, how can people be grouped to form archetypes? As we just mentioned there are two main motives that determine employees’ preferences for some types of work. Preferences can come from different sources: a sense of accomplishment or a sense of ownership. However, these dimensions and the themes that define them work in different ways for different types of employees. We propose that what differentiates people with respect to the appropriate mechanism for job preference is ‘time perception and time value’.

Accomplishment and ownership can be thought of as concepts that happen in different time frames. Accomplishing is a discrete event. Owning is a continuous property. Time takes different values depending on the concept that is feeding. Time to accomplish is a needed resource to get a result. In this case, time buys an end. Time in “own work” is an asset to spend on a preferred activity. In this case, time buys a process. Long-term and uncertain types of tasks are more suitable for people with a continuous sense of time. Well defined tasks where results can be attained in a reasonable time frame are preferred by people with a discrete sense of time. We will call these two archetypes (grouping of people with similar preferences) ‘explorers’ and ‘exploiters’, respectively.

Archetypes are general representations, not accurate descriptions of people’s identities that are relevant to the workplace. Some people show characteristics of both archetypes with one being more prevalent than the other. Thus, we suggest that these two types are not mutually exclusive. They are orthogonal dimensions that form a space. But not everyone can be identified as explorer or exploiter. Some people enjoy the task and role of being enablers. We call them ‘bridgers’.

In general terms, explorers express their appreciation for activities related to research and lab work that involve a high personal involvement in the development of new technology. Exploiters phrase their preferences for work in terms of solving technical problems and delivering technology. There are also people whose preferences exhibit a combination of the previously mentioned categories but also include a different dimension: bridging. The “bridgers”, independently of their exploration-exploitation preference, enjoy connecting people and
technology when they detect opportunities for collaboration on technology development.

Table 4 presents an example of quotations from different interviewees describing and commenting about different work activities. The table is organized by archetypes so that diverse perspectives about work type can be compared to each other. Archetypes in this table show strong differences in the way they describe work activities. However, this differentiation is not always so clear cut. Table 5 shows how quotations about favorite aspects of the work indicate sometimes moderate levels of different dimensions. Thus, when we refer to for example an explorer, we are talking about a person who shows higher interest for explorer-type of activities, behavior and interests than for other types of activities. On the right side of table 5 we can see the dominant concepts for each archetype.

What most explorers mentioned was the importance of working of what you want, which meant work on your own and new projects. The “owners” of those projects are highly involved in the development of those projects, which also allows them make high impact decisions on the deliverable. This sense or ownership brings and involvement brings them a sense of achievement and satisfaction. Explorers are more interested in being challenged to solve technical problems and work with an end in mind: bring projects to success, deliver. These are usually big missions so the satisfaction comes from the sense of achievement that successful missions inspire. We could suggest then that explorers have an individual orientation while exploiters have an organizational orientation.

When doing research, explorers express that they work long hours because they are very interested and motivated about their work, not because of schedule pressures. Explorers and explorers indicate that flight project work is intense in terms of deadline pressures, independently of how much they love that kind of work. Explorers time management is flexible and long term while exploiters work on the clock to deliver and they feel comfortable (or at least less uncomfortable) with defined tasks, procedures and deadlines. The value of time for these archetypes may help understand why some incentives are more meaningful than others. For example, time-off awards are completely unattractive for explorers. Most of them accumulate time-off because they are so personally invested in their work and so interested by it that they do not want to take time-off and if they do, they work anyways. Time is so valuable for explorers that the bureaucratic aspects of government work annoys them not because they are boring but because they are menial types of tasks and because they could be using that time to work on what they like, which is, their own projects.

Bridgers can be explorers or exploiters but they view work broadly and are proactive in connecting the pieces that have potential to work together. Bridgers are the ones that keep the exploration-exploitation efforts balanced in the system. They can be found in explorer, exploiters or managers position.

Identities in roles that do not match their preferences may learn from the experience but they may also burnout. The following are some examples of archetypes talking about the experience of filling a role that is not aligned to their archetypes’ preferences.

Explorer’s in a manager position: “I think that the biggest problem with the job is that I’m supposed to be a physicist and mostly I’m a secretary... so the biggest problem with my job is: I do the work for the work and my biggest complaint is: I don’t get to do the work.” (129)

Explorer: “Once you’ve done with one mission... you don’t want to do that again because for flight missions there are a lot of things that you don’t need or want to but you have to do and I don’t really want to do that again...For flight missions everything has to have traceability so you have to have paperwork for everything and it’s too much.” (513)

Explorer/bridger’s who work on exploration, exploitation and bridging: “[Flight project work] gives you more exposure. I think that’s definitely valuable... ultimately I’m trying to develop these new technologies for flight projects. Being involved in flight projects lets me see what are the components that I would need to worry about, what are the issues that I might run into.” (179)

In the following section we will discuss the management implications of the archetype identification presented in this paper.

V. DISCUSSION

Explorers, exploiters and bridgers are not mutually exclusive dimensions, which is consistent with some conceptualizations in the literature (Gupta et al., 2006). As previously showed, employees may exhibit characteristics from more than one archetype. Figure 3 proposes a way in which we can conceptualize archetypes in the space of motives that drive preferences. Sense of ownership and sense of achievement are not mutually exclusive: people may care about both, probably they prefer one more than the other. They seem to always have a strict favorite
activity. Thus, we believe that this space contains infeasible points such as (extreme exploiter, extreme explorer) and maybe all points where \( x = y \).

Explorers live in the dimension of high sense of ownership while exploiters live in the dimension of high sense of achievement. Explorers may tend to go to the extreme over time for reasons such as strong research groups that pressure for more time to work on explorative activities, success in exploration (the more success the more discretion), etc. Exploiters can also go to the extreme when they have been successful in projects. Bridgers might be explorers or exploiters that get away from the detailed work and focus on connecting the pieces.

![Figure 3: Identity space](image)

Employee’s time allocation distribution may change over time because of “external” reasons such as change of mission priorities and budget constraints, or internal reasons such as changes in preferences and new opportunities. Previous research has shown that individual technologists tend to focus on exploration or exploitations at particular points in their careers, severely limiting the assumed knowledge transfer mechanism (Szajnfarber, 2011). In the identity space this would look like a point moving towards one of the axes. If we think about this at an aggregate level, we would see denser distributions of people in the vicinities of the axes. We don’t know what the optimal distribution is, if one exists, but we do know that an extremely polarized distribution will not help the exploration-exploitation balance (March, 1991) in the context of punctuated equilibrium. We also think that a concentration of identities at the middle point of the space (no extremes) will not bring get the best out of exploration or exploitation efforts for either punctuated equilibrium models or ambidexterity with structural separation. Do identities travel quadrants (change archetypes) or do they stay within a limited area (change within an archetype)? Is this a matter of detecting identity, training, or both? With our current data we can’t answer all these questions. All these concerns are relevant for HR managers in terms of human resource planning, hiring, and staffing. These are only some of the issues that need to be explored in future research.

Birkinshaw & Gibson (2004) describe as ambidextrous those individuals who are alert and seek opportunities to combine efforts with others and even beyond their own job. Our definition of bridgers coincide with and expands Birkinshaw & Gibson’s. Although not as developed in this paper as the other two identities, bridgers are extremely important to maintain the balance and quality of the organization’s exploration and exploitation efforts. Although bridgers are not easily identifiable, there seems to be a great potential for them (or for other employees who exhibit some bridging identities) to be trained. The challenge resides in having the tools to identify them and also structurally and culturally prepare the organization to allow the bridgers to bridge.

Although this research seems to offer more questions than answers, it installs a topic that is worth pursuing both for theory and practice purposes. The more we characterize the differences in employees’ archetypes, the better the chances of creating effective incentive policies. It is necessary to understand what and how much they value what they do so that we can understand their decisions in their respective contexts.

VI. CONCLUSION

Exploration and exploitation efforts are fundamental for organizations, especially for R&D organizations. Highly trained employees have enough discretion in their time allocation to work on (or find the way to work on) exploration or exploitation type of activities. Ideally people work on different types of activities so that the feedback process from exploration to exploitation happens at an individual level yet in practice people tend to focus on one or the other, severely limiting the knowledge transfer. This flexibility that the system allows (willingly or unwillingly) is very hard to control. In this research we conducted an exploratory type of research that aimed to understand these highly trained employees who make these kinds of time allocation decisions. We collected data through in-depth, semi-structured interviews at a NASA center. Using grounded theory we found that there are three archetypes relevant to the exploration/exploitation balance: the “explorers”, “exploiters”, and “bridgers”.

We found these three different groups and what seems to make the difference is the source of
motivation, and the value that people assign to time and task. Exploiters enjoy results and the sense of accomplishment from successfully completing a task. Explorers enjoy the process of coming up with new ideas and carry them out themselves, which nurtures a sense of ownership. Bridgers can be explorers or exploiters but not an extreme of any. They have an additional characteristic that sets them apart. They appreciate both types of activities and they are alert to opportunities of cooperation and feedback.

All archetypes appreciate recognition but awards and other kinds of feedback don’t seem to deeply affect explorers. They want to continue doing what they want to do. It might be that because of the way exploiters value time, awards and recognition make a bigger impact in them than in explorers. A discrete event such a flight project success accompanied by an also discrete event of recognition seems a powerful combination in the eyes of exploiters.

The insights from this paper will be used in a subsequent research project that aims to answer broader questions and test hypothesis about technical professional preferences and managers’ expectations. More precisely, the insights from this study will help build hypotheses to be tested in a survey research that will generate representative data. All this will be then used to then construct an agent-based simulation model of individual behavior where incentive strategies can be tested.

This paper contributes to the extension of our theoretical understanding on individual ambidexterity by providing a possible explanation, based on grounded work, of the different organizational identities that make possible the execution of explorative and exploitative activities. These insights are envisioned to inspire new research questions.
The most favorite part of my job is to be able to do these amazing things like I can come up with a concept that is completely new but can have a huge impact for future NASA missions. To be able to carry out my idea is the best part. Once I can get some buy-in from funding people I can carry it out.

My favorite part of my job is getting to do research either do calculations, read papers, do tests in the lab. The things I like about... Is that there's always something new, there's always new problems, new questions... You are not just switching the shape of the headlight of a car. Problems come from all different directions and are always very different.

when I’m doing my research and I’m getting new data, I’m pushing the envelope of what is known by other people that’s really neat. When I get new data about something that nobody else has ever done before, that’s kind of exciting. So there’s a thrill in doing new things, learning new things, discovering new things that you didn’t expect... I really do enjoy that.

The fun part is actually doing essentially anything that you can think of you can actually propose and do.

I like the creative aspects of my work: being able to think of new ways of doing things.

<table>
<thead>
<tr>
<th>Quotations</th>
<th>ID</th>
<th>Codes</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>- Own work</td>
<td></td>
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<tr>
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<tr>
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</tr>
<tr>
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<td></td>
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<tr>
<td>The fun part is actually doing essentially anything that you can think of you can actually propose and do.</td>
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</tr>
<tr>
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<td></td>
<td></td>
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</tbody>
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Table 1: Quotation and codes examples

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quotation examples</th>
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<tbody>
<tr>
<td>Role implications</td>
<td>The favorite part of the job is doing something new, doing innovative things. (462)</td>
</tr>
<tr>
<td></td>
<td>It’s the freedom to work on what you like, that’s the best thing. Even though sometimes you have to work on what your boss says but it’s more than 50% freedom to work on what you like and also freedom to select the topic that you want to work on. (242)</td>
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<td>That’s the fun part of the flight mission that’s when you do a lot of prototyping, experiment, making sure that the ideas that you form... That the instrument is going to work. (513)</td>
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<td>Task implications</td>
<td>My favorite part is to see that we delivered things. It’s rewarding because technology development takes a long time and effort so it’s rewarding to see it fly. (746)</td>
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<td></td>
<td>...in some respects I think the flight project is more satisfying just because you have a beginning and an end, it’s a relatively short period of time, you can see an end product that is delivered. It’s producing something that’s useful that makes people happy... (951)</td>
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<tr>
<td>Role characteristics</td>
<td>I like being the role that I’m in because I still get to stay close enough to the technical work, although I’m not actually doing it anymore, and I have a chance to actually influence the culture and really watch the people develop and play a role in that. (705)</td>
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<td></td>
<td>Through all this, my style has been always the same. I was freed from being a supervisor so my analogy is like I could flow like water. I could just go and talk to people and learn about what they were doing... I’m in the middle child. I’m the peace maker... So that’s part personality.</td>
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</tbody>
</table>

Table 3: Quotation examples of second-order themes.
Research (exploration) | Achievement | Ownership
---|---|---
**Explorer** | Flight work is very intense, in my experience. Long hours, the deadlines are hard, there are no soft deadlines, decisions have to be made and they have to be moved on. Technically, the work can be quite technically challenging but not always and I guess the biggest frustration I always had with the flight work was dealing with all the paperwork, just the constant need to have all the paperwork updated, know that you did everything by the book… in some respects I think the flight project is more satisfying just because you have a beginning and an end, it’s a relatively short period of time, you can see an end product that is delivered. It’s producing something that’s useful that makes people happy… (951) | We are going to stick with the technology solution that we are most familiar with, that we have developed. We have developed it because we think is the best but that can’t go too far. You continue to insist in a technology solution that may not actually be the best but it’s what you know how to do… (948) | I guess the best description that people uses around here is that I am an influence leader, any management that I do is through influence. I try to get people to do things that are important to the division… What I do now is different from everything that I’ve done, it’s all about bringing people together, influencing people to do things (951)

**Explorer** | I like working on a [big mission]. It is a very unique project. It’s very exciting to think about what it’s going to achieve. One thing that I don’t like as much is the fact that it got started long before I came so I didn’t really see it from the beginning. So the idea of having this ultimate application, which can really revolutionize astronomy, it’s really exciting but the fact that I’m not as involved, you see less job satisfaction. (179) | My favorite part of my job is getting to do research either do calculations, read papers, do tests in the lab. The things I like about… Is that there’s always something new, there’s always new problems, new questions, every… You are not just switching the shape of the headlight of a car. Problems come from all different directions and are always very different. (391) | I think in a place like this, there’s so much stuff going on that you can either say: “oh, I can’t possibly keep track of that stuff” and just… focus on what you do; or you can say: “some of it may be relevant to me so I better keep my ears open”. And I certainly did the second. I was always listening and I had a pretty clear idea of almost anything on the center that was going on that had any significant overlap… I remember… thinking to myself, I said: “if I want to stay here and do something… you can’t do this… just by being smart and have good ideas.” There is a very… complex situation of figuring out how to use the resources that are here and how to get access to it. How to get people to do things is really “the” thing, that’s where all the leverage is in this… (280)

**Bridge** | ...ultimately I’m trying to develop these new technologies for flight projects. Being involved in flight projects lets me see what are the components that I would need to worry about, what are the issues that I might run into. (179) | ...every now and then you have an idea and it’s a big team of people to help you implement it, it’s a little too much work to have the idea, built it, meet all the specs, tested, and analyze the data, it’s a long pipeline and so you rely on teams of probably 10 people would be involved in one idea. So you do have to build consensus or your ideas get shut down or not tested so there’s a lot of work in the politics of just getting something through that you think is good and it’s also bummer when the thing you thought was going to pay off it doesn’t get proved but it’s great how the pipeline works. (642) | So I spent all these years getting a PhD in engineering, which is fine but I was never a hard-core researcher. I enjoy the technology or seeing the applications but I also enjoy when people can work together. I like when organizations work well. I appreciate the detailed work, how much effort takes to get things to work and organizations to work. I appreciated the engineering culture and the science culture but also the tension between them is kind of entertaining. But I also know how hard it is. You get to have good teams to be successful. Through all this, my style has been always the same. I was fired from being a supervisor so my analogy is like I could flow like water. I could just go and talk to people and learn about what they were doing… I’m the middle child. I’m the peace maker… So that’s part personality. (741)

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**Archetype** | **Favorite aspects of the job** | **Concepts**
---|---|---
**Explorer** | it’s the freedom to work on what you like, that’s the best thing. Even though sometimes you have to work on what your boss says to work on but it’s more than 50% freedom to work on what you like and also freedom to select the topic that you want to work on. (242) | Ownership

**Explorer** | … doing essentially anything that you can think of you can actually propose and do. I think of my job as a university professor without any teaching load. If you can find time to actually go to the lab and make things happen and then write papers and send it off to publications. (513) | Ownership

**Bridge** | The most favorite part of my job is to be able to do these amazing things like I can come up with a concept that is completely new but can have a huge impact for future NASA missions. To be able to carry out my idea is the best part. Once I can get some buy-in from funding people I can carry it out. (179) | Ownership

**Explorer / Bridge** | The favorite part of the job is doing something new, doing innovative things. Often if I get frustrated by things, which I will come in the least favorite parts, I get to think in the big picture of what I’m doing and the big picture of what I’m doing is really quite dramatic… Thinking about sending humans to Mars or asteroids or sending a spacecraft to orbit Titan, that really big picture is so exciting. So the big picture as well as the new things I get to learn and do every day, when I’m doing my research and I’m getting new data, I’m pushing the envelope of what is known by other people that’s really neat. When I get new data about something that nobody else has ever done before, that’s kind of exciting. So there’s a thrill in doing new things, learning new things, discovering new things that you didn’t expect… I really do enjoy that. (462) | Ownership

**Manager / Explorer** | see that we delivered things. It’s rewarding because technology development takes a long time and effort so it’s rewarding to see it fly. (746) | Achievement

**Explorer / Bridge** | I like the interactivity with the branch members that are doing technology. …in some respects I think the flight project is more satisfying just because you have a beginning and an end, it’s a relatively short period of time, you can see an end product that is delivered. It’s producing something that’s useful that makes people happy… (951) | Achievement

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**Table 4: Work activities per archetype**

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