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Occupational Identity Formation in Unsaturated Spaces: The Layered Accretion of the American Astronaut's Identity

Evelyn Micelotta,[1] Giulia Cappellaro,[2] Claudia Gabbioneta,[3] and Michael G. Pratt[4]

Abstract

How does the process of identity formation unfold in emerging occupations? While extant research has focused primarily on occupational identity formation through differentiation from other occupational groups, we theorize identity formation in occupations that emerge in unsaturated spaces, where competitive dynamics are less salient. We address this question through a qualitative historical analysis of American astronauts at the inception of space exploration (1958–1974). Our work theorizes layered accretion as a distinct identity formation process whereby a new occupation's identity begins with importing an identity from an existing occupation (proto identity), refinement of the identity through work–identity alignment (core identity), and subsequent layering of new, distinct identities that are accreted on to the core. We specify the mechanisms underpinning layered accretion and contribute to deeper understanding of how multiple identities are managed in the early stages of identity formation in new occupations.

Keywords: occupational identity, identity formation, new occupations, historical analysis, qualitative methods

By informing the central question for occupational members of ''who we are'' as an occupation, identities play crucial roles. They facilitate the socialization of newcomers into established practices, cultures, and values, thereby imbuing occupational work with meaning and purpose (Anteby et al., 2016; DiBenigno,

[1] University of Vermont
[2] Bocconi University
[3] University of York
[4] Boston College

Corresponding author:
Evelyn Micelotta, Grossman School of Business, 55 Colchester Ave., Burlington, VT 05405
Email: evelyn.micelotta@uvm.edu

2018; Pratt et al., 2006). Identities also serve as catalysts for collective action, fundamentally shaping whether occupational members embrace or resist changes to established work practices (Goodrick & Reay, 2010; Howard-Grenville et al., 2017; Kyratsis et al., 2017; Nelson & Irwin, 2014).

Despite the acknowledged importance of identities, our understanding of how occupational identities form remains considerably underdeveloped. Research thus far has offered differentiation from established occupational groups as a key explanatory mechanism for occupational identity formation (Anteby et al., 2016; Sherman, 2010). Grounded in classic sociological scholarship that emphasizes competitive jurisdictional dynamics as dominant forces (Abbott, 1988; Bucher, 1988; Bucher & Strauss, 1961), extant research has examined mostly occupations that emerge within saturated environments, which are spaces in which inter-occupational jurisdictional competition dictates what a new occupation is allowed to do and who its members can be. Not surprisingly, this research theorizes identity formation as an inherently competitive process, underpinned by mechanisms that involve new occupational members finding commonalities and shared meanings while simultaneously differentiating from existing occupational groups (Fayard et al., 2017; Jeon, 2010; Lounsbury, 1998; Murphy & Kreiner, 2020).

Emerging evidence, however, suggests that these well-known dynamics and mechanisms may be insufficient for a comprehensive theoretical understanding of how occupational identities form. The emphasis on competitive jurisdictional processes in saturated spaces has overshadowed the important potential role of internal identity dynamics for occupations (see, for example, Bourmault & Anteby, 2023). Additionally, a growing number of occupations seemingly encounter minimal inter-occupational competition during their formative stages. Examples include occupations created in response to regulatory changes or civic society's articulated demands for normative change, such as sustainability managers in higher education (Augustine, 2021; Augustine et al., 2025), diversity managers (Dobbin et al., 2007), and corporate social responsibility managers (Risi & Wickert, 2017). Similarly, policy-driven technological developments provide new occupational niches with an external mandate and populate them with individuals with specific backgrounds, such as air traffic controllers (Vaughan, 2021), nuclear specialists (Johnston, 2011), and astronauts (Carton, 2018). This latter observation raises a fundamental theoretical puzzle: How do occupational identities form in the absence of significant other identities against which to define themselves?

To address this puzzle, we need to better understand occupations that emerge within ''unsaturated spaces,'' a concept we developed to define spaces in which the emergence of new occupations is characterized by minimal jurisdictional competition from established occupations. In these spaces, new occupations do not compete with existing groups for legitimacy. Instead, other factors—such as externally defined mandates (like the state security agenda that created nuclear scientists in Johnston, 2011) and selective recruitment—make inter-occupational competition less relevant for explaining identity formation. Understanding this alternative pathway to identity formation is crucial for developing a more comprehensive account of identity formation and for rebalancing the dominant focus on inter-occupational jurisdictional competition and differentiation. Recognition of these unexplored circumstances of identity formation motivates our central research question: When occupations cannot

define themselves through processes of differentiation from existing occupational groups, how do they construct a sense of occupational identity?

To address this question, we conducted a qualitative historical analysis of the emergence of a well-documented occupation in recent history: American astronauts. Prior to the establishment of the National Aeronautics and Space Administration (NASA) in 1958, space exploration was science fiction. The launch of the American space program formally created a new occupation: the astronaut. By tracing the emergence of astronauts as an occupational group selected among military test pilots, we illuminate how this occupation's identity formation process unfolded not through a competitive inter-occupational process of differentiation but through layered accretion of multiple identities. Our analysis reveals that the astronaut occupation began with importing an identity (military test pilot) from an existing occupation (proto identity); its refinement occurred through work–identity alignment (core identity) and the subsequent layering of new distinct identities (first engineer and later scientist) that were accreted on the core to become part of the occupation's identity. The resulting astronaut identity emerged as a complex layered identity in which the core identity dominated while additional layers organized in a hierarchical fashion around the core.

We theorize the mechanisms that drive this formation process: the extent to which future work demands are aligned with the current identity (work–identity alignment) and the extent to which the accreted identity supports the ongoing expression of the core identity and the tasks it embodies (core–accreted identity synergy). We explain differences in the layering of the two additional identities on the core: The synergistic engineer identity was layered on to the core through hierarchical aggregation, whereas the poorly synergistic scientist identity was layered through hierarchical segregation. By adopting a historical perspective and examining the full arc of the astronaut occupation's identity formation process, we theorize layered accretion as a novel process of identity formation for new occupations emerging in unsaturated spaces.

OCCUPATIONAL EMERGENCE AND IDENTITY FORMATION

According to Abbot (1988), new professions develop when jurisdictions become vacant, either because such jurisdictions are newly created or because an earlier occupant has left or lost its grip on them. In many cases, new occupations arise in environments in which other occupations already exist. In these saturated environments, in which (one or more) existing occupations serve as reference points and competitive dynamics shape their interactions, emerging occupations must define what is both shared and distinctive about themselves. This process is crucial for articulating occupational mandates, establishing legitimacy (George, 2013), and asserting jurisdiction vis-à-vis other occupational groups (Bucher, 1988; Fayard et al., 2017; Nelsen & Barley, 1997; Zetka, 2003).

This reasoning underpins much of the existing literature on occupational emergence, but extant research has not offered direct insights into how new occupations form identities. In most of the occupational literature, identity is not the explicit focus of analysis, as scholars have directed attention toward other important issues, such as how occupations establish mandates, define jurisdictional boundaries, and professionalize (Anteby et al., 2016; Nigam & Dokko, 2019). Only recently has the occupational literature begun to frame these

contributions in terms of identity. To ground our research, we also reviewed works relevant to our inquiry that predate the development of occupational identity theories, since mandates and jurisdiction shape what an occupation does and does not do, and ''doing'' lies at the core of occupational identity (Anteby et al., 2016, p. 183). This line of research suggests a powerful mechanism through which new occupations may forge a shared and distinctive identity in saturated spaces: They do so by differentiating themselves from established occupational groups.

Identity Formation Driven by Differentiation from Existing Occupations

In the literature, the emergence of a new occupation is conceptualized as a multistage process. Scholars have focused on how new members find one another (Lounsbury, 1988) and on how they define who they are, what keeps them together, and what makes them different from others (Hughes, 1958; Nelsen & Barley, 1997). This process unfolds by members creating a sense of belonging and purpose, delineating clear boundaries around their domain of practice (Abbott, 1988), and defining and codifying their unique expertise (Bucher & Strauss, 1961). At the heart of emergence lies the formation of a shared occupational identity, a constellation of attributes, beliefs, and values that provides members with meanings they can attach to and that distinguishes them from other groups (Ashcraft, 2013; Kreiner et al., 2006; Pratt et al., 2006).

Most studies of occupational emergence do not theorize identity formation as a focal construct, but valuable insights can emerge from understanding the construction of an occupational mandate and the claiming of a distinctive jurisdiction. Indeed, an occupational mandate constitutes ''the internally shared understanding and the externally perceived right to define 'proper conduct,' as well as values, beliefs, and ways of thinking'' (Fayard et al., 2017, p. 271; see also Hughes, 1958). The formation of an identity is conceptually embedded in the definition and assertion of jurisdictional claims made against other occupational groups. When nascent occupations assert control over previously unclaimed tasks, they ''value these tasks highly, hold them as distinctively theirs, and develop their identities around them'' (Zetka, 2011, p. 839; see also Bucher & Strauss, 1961). This phenomenon is exemplified by surgical specialties such as urology and anesthesiology, which, in their quest for independence, articulated distinct identities to establish their uniqueness.

This line of research has advanced knowledge by showing that differentiation over expertise is not the only mechanism of jurisdictional boundary setting and that practices grounded in moral values can provide equally strong foundations for distinguishing different groups of practitioners (Anteby, 2010). Fayard and colleagues (2017, p. 270), for instance, showed that service designers establish distinctive values embedded in material practices, specifically through what they term ''ethos,'' the way in which values infuse work practices. Service designers leveraged this ethos to differentiate themselves from related occupations in their professional ecosystem, including designers, management consultants, and marketers, thereby carving a unique mandate without relying on claims of specialized knowledge.

Other research on occupational emergence has examined identity formation as a focal construct. These articles emphasize that new occupations emerge

through jurisdictional contestation by securing authority over specific work domains and tasks (Abbott, 1988; Ashcraft, 2013). In competitive spaces, seeking legitimacy drives self-categorization, and identity formation manifests through comparative and contrastive processes with other occupational groups (Clegg et al., 2007; Murphy & Kreiner, 2020; Vaast et al., 2013; Vaast & Pinsonneault, 2021). One way for emerging occupations to form their identities is by asserting superior expertise, to claim control over work definition and scope or unique practices as a source of distinctiveness (Bucher, 1988; Hughes, 1958). Business coaches, for instance, developed a sense of being legitimate players by creating categories that classified them as ''facilitators'' or ''helpers,'' thus differentiating them from consultants, who saw themselves as ''experts'' (Clegg et al., 2007, p. 502).

Similarly, in the early 1920s, aerologists (a sub-discipline of meteorology) positioned themselves as expert advisors to pilots but advocated for their own flight training. Military pilots collecting weather data struggled to define their identity, as their tasks lay between specialized aerological duties and those of traditional career paths (Jeon, 2010). In the digital domain, tech bloggers claimed a distinctive identity as commentators on Web 2.0 developments. As ''self-proclaimed technology evaluators and leading-edge users'' (Vaast et al., 2013, p. 1079), tech bloggers' identity claims distinguished them from journalists by emphasizing their independence and specialized expertise on Web 2.0 issues (Vaast et al., 2013). Data scientists also grappled with similar tensions (Vaast & Pinsonneault, 2021). Claiming that interdisciplinarity constituted the occupation's distinctiveness, they positioned their identity at the intersection of different knowledge domains (mathematics, engineering, and computer science) and claimed expertise in crossing disciplinary boundaries (Avnoon, 2021; Vaast & Pinsonneault, 2021).

The need to establish legitimacy in saturated spaces leads members of emerging occupations to construct ''identity content'' (Murphy & Kreiner, 2020, p. 871) that allows them to pursue differentiation while also establishing similarity (i.e., optimal distinctiveness) through carefully crafted boundary strategies. Health and wellness coaches (Murphy & Kreiner, 2020) simultaneously pursued identity novelty and familiarity. Boundary-setting practices positioned their expertise in direct opposition to that of incumbent health care professions such as physicians and nurses; boundary-blurring tactics emphasized similarities with those professions, thereby facilitating acceptance. Through comparative processes, emerging occupations simultaneously borrow legitimacy from established fields while carving out distinctive domains of expertise and practice that justify their separate existence.

In these ways, occupational scholars have identified differentiating mechanisms as the primary drivers of jurisdictional positioning of new occupations, in vacancies that are created or become available in saturated spaces, and in which legitimacy is a deep concern and other occupations provide crucial reference points. When scholars have examined explicitly the process of identity formation, they found that nascent occupations engage in dynamics that define them both in terms of similarities to and in contrast with existing occupations.

Although theoretical development centered on competition for jurisdictional control and legitimacy provides a strong explanatory framework for how new occupations emerge and how their identities form, the focus on occupational jurisdictional boundaries has likely overshadowed other important dynamics

that are internal to the emerging occupation and that may significantly affect these processes. For example, new occupations may also emerge when there is no significant pressure to differentiate themselves from existing occupations or to actively seek legitimacy. These domains, which we define as unsaturated spaces, may be present in novel or rapidly evolving fields in which established occupations are absent and do not offer a reference point or in which these occupations are insufficient or inadequate to cover new roles and tasks. Likewise, these spaces may offer occupational vacancies that already have a legitimate mandate, such as those externally provided by policies or backed by the normative pressures of social movements. The vacancy is then filled by new occupations that can position themselves and engage in identity formation without the constraints (and reference points) that inter-occupational contention typically provides.

Occupations Emerging in Unsaturated Spaces: Insights for Identity Formation

Without the pressing need to define themselves against existing occupations, how do new occupational members form their identity? Some research has explored this theoretical possibility, in particular studies focused on occupations that emerge with a specific mandate and therefore do not experience competition or the quest for legitimacy. Regulations and normative changes, for instance, confer institutionally prescribed mandates to newly formed occupational groups, such as occupational program consultants (Blum et al., 1988), chief financial officers (Zorn, 2004), ethics and compliance officers (Treviño et al., 2014), and sustainability managers (Augustine, 2021). Similarly, certain policy initiatives create protected technological niches occupied exclusively by specific groups, as evidenced in the emergence of nuclear specialists (Johnston, 2011) and astronauts (Carton, 2018).

Occupations that arise with an external mandate are salient for theorizing unsaturated spaces, although knowledge of identity formation in mandated new occupations remains remarkably limited. Existing studies suggest that such occupations form when individuals with diverse professional backgrounds enter formally established roles, which eventually crystallize into distinct occupations (Blum et al., 1988; Johnston, 2011). The selection process that establishes which individuals are considered suitable for entering the new occupation would seem to be important for establishing the new occupation's initial identity. For instance, Blum et al. (1988) examined the emergence of occupational program consultants (OPCs) in the United States during the 1970s, which had the mandate to implement employment assistance programs within organizations. New occupational members were individuals with backgrounds in either social work or business administration, possessing distinct identities. Considering the occupational jurisdiction literature, the authors expected the new occupation to emerge out of the inter-group conflict over the OPCs' technical arena. Surprisingly, they found no competitive dynamics at play. The study shows that the normative guidelines that created the occupation and the socialization processes among these members within the organization were able to ''override the polar ideologies and skills that may be derived from formal education'' (Blum et al., 1988, p. 111) and facilitated the formation of a shared identity across previously distinct subgroups. The mechanisms

underlying the formation of this shared identity, however, remain undertheorized.

A study by Johnston (2011) on the emergence of the new occupation of nuclear specialists (1940–1960) in the U.K., Canada, and U.S. provides further insight into occupations created with a clear mandate, in this case the development of atomic energy projects. Once again, the selection of new members of the occupation was a central process that allowed an amalgamation of professionals from distinct disciplinary domains: scientists (physicists and chemists) and engineers. The national security imperatives of secrecy drove the process of identity formation. In this case, powerful institutional actors (national governments) actively shaped occupational identity by ''filtering the workforce, subsidizing . . . development, helping to create disciplinary categories, and supporting particular forms of professional identity'' (Johnston, 2011, p. 142). Yet, besides the governmental institutional role in such ''cloistered development'' (Johnston, 2011, p. 143), little is known about whether those different disciplinary identities ever formed a shared identity, and if they did, how they did so.

Finally, research on recycling coordinators and sustainability officers in higher education reveals the complexities of identity formation absent inter-occupational competition and with external mandates (Augustine, 2021; Augustine et al., 2025; Lounsbury, 2001). Lounsbury (1998, 2001) and Augustine et al. (2025) examined recycling coordinators in U.S. colleges and universities, an occupation created by normative pressures from grassroots student environmental activism. Selection processes significantly shaped the nascent occupation's identity formation. Though recycling positions were created ex novo in formal programs, they were mostly filled with existing employees who showed little interest in environmental ideals or program development. Activist-oriented, full-time employees were the minority. Without reference points from other occupations and facing uncertain tasks (''there was no precedent on how to do recycling,'' as quoted in Augustine et al., 2025, p. 38), recycling coordinators negotiated tensions between developing operational expertise and embedding movement ethos into higher education. Over time, the occupation's identity solidified around the ''operational core'' (2025, p. 49), which constrained it when universities embraced sustainability and members attempted to reclaim their roots as ''environmental champions.'' These studies highlight how identity formation in new occupations can be driven by internal dynamics rather than by differentiation from competitors. Notably, the recycling coordinator occupation had disappeared by the time sustainability managers emerged.

Augustine's (2021, 2025) work on sustainability managers extends these insights by documenting how another occupation arose to address campus sustainability demands. The occupational demise of recycling coordinators left a vacancy in this unsaturated space. Sustainability managers did not define themselves against recycling coordinators, and jurisdictional competition played no role in their identity formation. Instead, Augustine's research demonstrates that the ambiguous external mandate gave sustainability managers leeway in defining their jurisdiction. Sustainability managers entered with different backgrounds and navigated internal tensions between activism and the ambition to ''perform neutrality'' (Augustine, 2021, p. 1069), eliminating work areas consistent with their mandate but perceived as too political. The occupation's identity

formation was thus driven by internal dynamics, as members constructed identity around standardized non-political tasks.

These studies highlight the theoretical importance of exploring further the internal dynamics of identity formation that are driven by mechanisms other than differentiation and jurisdictional competition and the characteristics of the unsaturated spaces in which this process occurs. While not fully articulating a theory of occupational identity formation, existing research points to the selection of different groups into the new occupation as a critical starting point. In unsaturated spaces, multiple group identities (often from different occupations) are brought into the new occupation, but the processes through which they interact to form a cohesive identity that transcends initial group identities are not well understood. Multiple subgroup identities may coexist during an occupation's early formation (see also Elias, 1950; Moelker, 2003), but diverse patterns can also emerge over time. Multiple identities may persist in tension, hierarchically organize, or ultimately merge into novel hybrid forms, but these possibilities have not been examined empirically.

Other realms of management research have recognized the theoretical importance of multiple identities. Indeed, there is a growing body of research on multiple identities, but this has focused on the organizational level (Pratt & Foreman, 2000) and individual level of analysis (Ramarajan, 2014; Ramarajan & Yen, 2024), neglecting the identities of occupations. These studies show patterns of relationships among multiple identities and explain how multiple identities shape people's actions and organizational outcomes. Translating these findings to the occupation literature can help us better understand the complexity of the identity formation process in new occupations, particularly whether and why certain identities (or combinations of identities) come to dominate an emergent occupation. Investigating these questions can further advance our understanding of how occupations emerge and develop.

METHODS

Empirical Setting

The case of American astronauts offers an ideal empirical setting for examining identity formation processes in unsaturated spaces. Unlike occupations that develop within saturated spaces, the astronaut occupation in the U.S. emerged in a fundamentally novel technological domain with no pre-existing occupational competitors and a strong external mandate (Carton, 2018; Smith et al., 2020). The absence of competition created unique conditions for the identity formation process, eliminating the need for new members to differentiate and legitimate the new occupation's existence. Furthermore, the astronaut occupation offers unparalleled advantages for scholarly investigation due to its extensively documented history. NASA's archival records, along with abundant autobiographical accounts, media coverage, and institutional histories, allowed us to trace the occupation's development from its inception in the late 1950s until the 1970s.

Research Design and Data Sources

We adopted a historiographic design for our data collection (Cappellaro et al., 2021; Ventresca & Mohr, 2002). The first documents we examined were produced in 1958, the year in which the newly established National Aeronautics

and Space Administration began to recruit the first cohort of astronauts. We collected data about all the astronauts recruited in the first seven cohorts (between 1959 and 1969). After 1969, NASA stopped recruiting new astronauts, and the hiatus in space exploration lasted until 1978, when the Shuttle project began. Our initial review of historical data suggested that the astronaut identity was relatively settled by the early 1970s, so we stopped data collection before the hiatus. This approach yielded an initial sample of 73 astronauts in seven cohorts: the Mercury Seven[1] (selected in 1959); the New Nine (1962); the Fourteen (1963); the Scientists (1965) (six astronauts); the New Nineteen (1966); the XS-11 (1967); and the seven Manned Orbiting Laboratory astronauts (MOL, 1969). We then identified astronauts who left NASA (e.g., Curt Michel, Duane Graveline), died in accidents before being assigned to any flight (e.g., Ed White, Elliott See, Charles Bassett, Roger Chaffee, Theodore Freeman, Clifton Williams), or did not actively participate in missions in the time frame of our analysis (i.e., the seven MOL). We primarily focused our data collection and later analysis on a final sample of 65 astronauts belonging to the first six cohorts, who participated in the first four NASA programs: Mercury, Gemini, Apollo, and Skylab. We focused on data from 1958 to 1974, for a total of 31 missions.

We triangulated data from different sources, listed in Online Appendix 1. In total, the collected material comprises more than 24,000 pages. The archival source we gathered data from first was the NASA archives of the Johnson Space Center Oral History project, which contains primary interviews with nearly 400 staff members directly involved in space activities since the establishment of the organization.[2] From the archives, we selected all available interviews conducted with the astronauts belonging to the selected groups (56 interviews, 12,994 pages, with 36 astronauts; some astronauts were interviewed more than once). The interviews followed a personal biographical approach and included questions on the informants' personal background, their recollection of main events and motivations leading to their decision to apply for the job, and the main tasks and activities they conducted. The interviewers encouraged the astronauts to be candid and detailed about their missions, key events, opinions, and their relationships with colleagues and NASA.

The archival source we gathered data from next was astronauts' autobiographies (34 biographies, 27 astronauts), which are published texts, typically written from a first-person perspective, and provide the history of the astronauts' lives and their years at NASA. Autobiographies represent a nontraditional data source (Bansal & Corley, 2011) that is useful for capturing the perspectives of individuals who entered the occupation at different points in time regarding their own identity and the identity of the occupation. Autobiographies are also a valuable data source for addressing temporally oriented research questions in which matters of social context are critical (Mathias & Smith, 2016). Recognizing that autobiographies may introduce bias, we took several steps to mitigate these concerns (Mathias & Smith, 2016). First, we addressed potential success bias, which can arise when autobiographies are written by only a few influential

[1] The Mercury Seven are sometimes referred to as the Original Seven. Although in the text we consistently refer to them as the Mercury Seven, some of the speakers in quotations refer to them as the Original Seven.

[2] https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/

individuals. This risk is limited in our case, as early astronauts did not differ substantially from others in their opportunities to publish autobiographical accounts (see Online Appendix 1). Nonetheless, to address this potential bias, we triangulated the autobiographies with other sources (e.g., interviews and personal accounts in *LIFE* magazine) to capture the astronauts' perspectives outside of published autobiographies. Second, we mitigated social desirability and correspondence biases, which are the tendencies to present oneself favorably and to attribute success to personal traits rather than to contextual factors, by checking the same information across multiple sources. Finally, to address potential authenticity bias in autobiographies written with co-authors or possible ghostwriters, we verified accuracy across sources and confirmed accounts in the individual interviews.

To capture the context in which the occupation emerged, we integrated the astronauts' narratives with other sources of data. We collected all the issues of *Roundup*, the official newspaper of the NASA Lyndon B. Johnson Space Center, published between January 1961, its first edition, and December 1974. We gathered 344 issues, each of which is eight pages on average (total 2,728 pages). The newspaper offers useful details about the development of technology and missions. We also retrieved all the issues of *LIFE* magazine published from 1959 to 1974 that contained a reference to the astronauts or the space program (85 issues). Until 1970, *LIFE* had a contract providing exclusive access to the homes and lives of astronauts. Finally, we collected miscellaneous secondary material (e.g., Congressional hearings, articles in other magazines, books, and documentaries and movies available on YouTube and other streaming services) germane to our research question. Overall, we sought to create a multivocal sample, with material produced in different outlets, from different authors, and at different times. We used this material to triangulate data sources, appreciate various perspectives about the same issues, and cross-check factual data, while developing our interpretation and theorizing. Online Appendix 2 provides evidence of this data triangulation.

Data Analysis

Our data analysis strategy followed a methodological bricolage approach that combined elements from multiple methodological traditions (Pratt et al., 2022). Specifically, we employed process theorizing to understand how the occupation evolved over time (Langley, 1999) and to delimit the data corpus for further analysis. We then continually applied comparison techniques (Strauss & Corbin, 1990) to examine how different astronauts made sense of their occupational identity, and to iteratively develop a broader set of theoretical categories. For clarity, we describe our analytical process in linear stages, although these were iterative and overlapping. Each phase of our analysis was guided by a discovery or insight from the previous round.

Historical reconstruction of events and actors involved in the emergence of astronaut occupation. We began by constructing a historical narrative of key events (Table 1). We compiled biographical sketches for each astronaut, categorized them by recruitment cohort, and traced their roles (prime crew, backup crew, support crew, training) in different programs and missions (Table 2).

Table 1. Timeline of Main Events

Date	Astronaut Selection	Mission/Program	Sociopolitical Context
October 1957		Launch of Sputnik, first artificial Earth satellite, by the Soviet Union	Ongoing Cold War between U.S. and Soviet Union Beginning of the Space Race
October 1958	Founding of the National Aeronautics and Space Agency (NASA)	Creation of a national manned space-flight project, later named Project Mercury	President Eisenhower signs the National Aeronautics and Space Act into law
April 1959–November 1960	April 1959: NASA announced the first astronaut crew: Mercury Seven (Group 1)		November 1960: John F. Kennedy is elected president of the United States
April–May 1961		First cosmonaut in orbit from Soviet Union (Gagarin) The U.S. launches the first American astronaut (Shepard)	
February 1962–May 1963	September 1962: NASA announced the second astronaut crew: New Nine (Group 2)	Mercury missions completed	September 1962: Kennedy delivers the ''We Choose to Go to the Moon'' speech in front of a crowd of 40,000 at Rice University in Texas
October–November 1963	October 1963: NASA announced the third astronaut crew: The Fourteen (Group 3)		November 22, 1963: Kennedy is assassinated in Dallas; Lyndon B. Johnson is sworn in as president
March 1965–November 1966	June 1965: NASA announced the fourth astronaut crew: The Scientists (Group 4) April 1966: NASA announced the fifth astronaut crew: The Original Nineteen (Group 5)	Gemini missions completed	March 1965: The U.S. enters the Vietnam War March 1965: Civil rights unrest: Selma to Montgomery marches
March 1967–April 1968	August 1967: NASA announced the sixth astronaut crew: XS-11, Excess Eleven (Group 6)	March 1967: Apollo 1 fire. Apollo program paused for investigation	April 1968: Civil rights unrest: assassination of Martin Luther King, Jr.
October 1968–December 1972	August 1969: NASA announced the seventh astronaut crew (Group 7)	Apollo missions completed July 1969: Apollo 11 landing on the Moon	November 1968: Richard Nixon is elected president of the United States 1970: Congress cuts NASA budget from $4 billion in 1969 to $3.7 billion
May 1973–February 1974		Skylab missions completed	1973: End of American involvement in Vietnam War 1974: Congress cuts NASA budget to $3 billion

Table 2. Astronauts by Recruitment Year and Missions by Program

			Astronaut Group			
Mission	Mercury Seven (1959)	The New Nine (1962)	The Fourteen (1963)	The Scientists (1965)	The Original Nineteen (1966)	XS-11 (1967)
Mercury (1961–1963) Pilot	Shepard (P) Grissom (P) Carpenter (P) Schirra (P) Cooper (P)					
Gemini (1965–1966) Command Pilot–Pilot	Grissom (CP) Cooper (CP) Schirra (CP)	Young (P) McDivitt (CP) White (P) Conrad (P) Stafford (P) Borman (CP)-Lovell (P) Armstrong (CP) Stafford (CP) Young (CP) Conrad (CP) Lovell (CP)	Scott (P) Cernan (P) Collins (P) Gordon (P) Aldrin (P)			
Apollo (1968–1972) Commander– Command Module Pilot–Lunar Module Pilot	Schirra (C) Shepard (C)	Borman (C)–Lovell (CMP) McDivitt (C) Stafford (C) Armstrong (C) Conrad (C) Lovell (C) Young (C)	Eisele (CMP)–Cunningham LMP) Anders (LMP) Scott (CMP)–Schweickart (LMP) Young (CMP)–Cernan (LMP) Collins (CMP)–Aldrin (LMP) Gordon (CMP)–Bean (LMP) Scott (C) Cernan (C)	Schmitt (LMP)	Swigert (CMP)-Haise (LMP) Roosa (CMP)-Mitchell (LMP) Worden (CMP)-Irwin (LMP) Mattingly (CMP)-Duke (LMP) Evans (CMP)	
Skylab (1973) Commander–Pilot–Scientist		Conrad (C)	Bean (C)	Kerwin (S) Garriott (S) Gibson (S)	Weitz (P) Lind (P) Bull (C)–Pogue (P)	

While astronaut recruitment occurred in a relatively short window (1959–1967), mission assignments of the astronaut groups continued into the 1970s.

Coding of (multiple) identities. Our next step was to code in chronological order the astronaut interviews and biographies, focusing on segments in which individuals reflected on their identity, the nature of their work, and their interactions with peers and external stakeholders. Our early coding revealed that, while astronauts viewed who they were differently over time, some identity meanings seemed relatively invariant, particularly those that corresponded to being test pilots. The first cohort of astronauts referred consistently to their prior occupational identity. This led us to create a provisional label of ''proto identity,'' which existed at the start of the occupational formation (e.g., ''military test pilots''). Over time, we discovered that the astronaut's occupational identity underwent changes as new members were selected to enter the occupation. We created categories around ''core'' (e.g., ''test pilots'') and ''latent'' (e.g., ''military'') identities, which had lingering elements of the proto identity but were either manifest or hidden, respectively. As we continued our coding, we noted that these core and latent identities persisted, but new cohorts of astronauts who selected into the occupation introduced different identities (engineer and scientist).

The interaction among (multiple) identities. Building from this insight, we asked ourselves ''how'' and ''why'' questions, similar to what would occur in creating more-abstracted codes via axial coding (Strauss & Corbin, 1990). Specifically, we asked ourselves why astronauts formed this proto identity, how this proto identity became the core identity of the emerging occupation, and how new identities that entered the occupation over time (engineer and scientist) became part of the developing astronaut identity. These questions led us to provisionally highlight data excerpts regarding the recruitment of the first cohort, imagined work demands, and organizational influence. For example, we created codes around ''selecting military test pilots,'' ''what early members imagined astronauts' role would be,'' ''test pilots' asserting a new role for astronauts,'' and ''constraints of forming a civil (vs. military) organization in NASA.'' As we further examined our data corpus in terms of other identity labels associated with astronauts over time, such as ''engineer'' and ''scientist,'' we questioned the data to understand why these new identity meanings emerged and how, if it all, they related to the core identity. This led us to code passages regarding selection of cohorts, the expansion and diversification of work demands, and socialization and how different forms of it related to different types of relationships with an emerging identity and the core. For example, we created codes such as ''selecting new astronauts with engineering [or science] backgrounds,'' ''including new cohorts into daily astronaut activities,'' and ''sending new cohorts off to flight school off base.'' We also coded for existing cohorts' reactions to incoming cohorts, noting that some cohorts were enthusiastically welcomed, while others were viewed with suspicion. These reactions gave us initial insights into how these newer identities related to the core

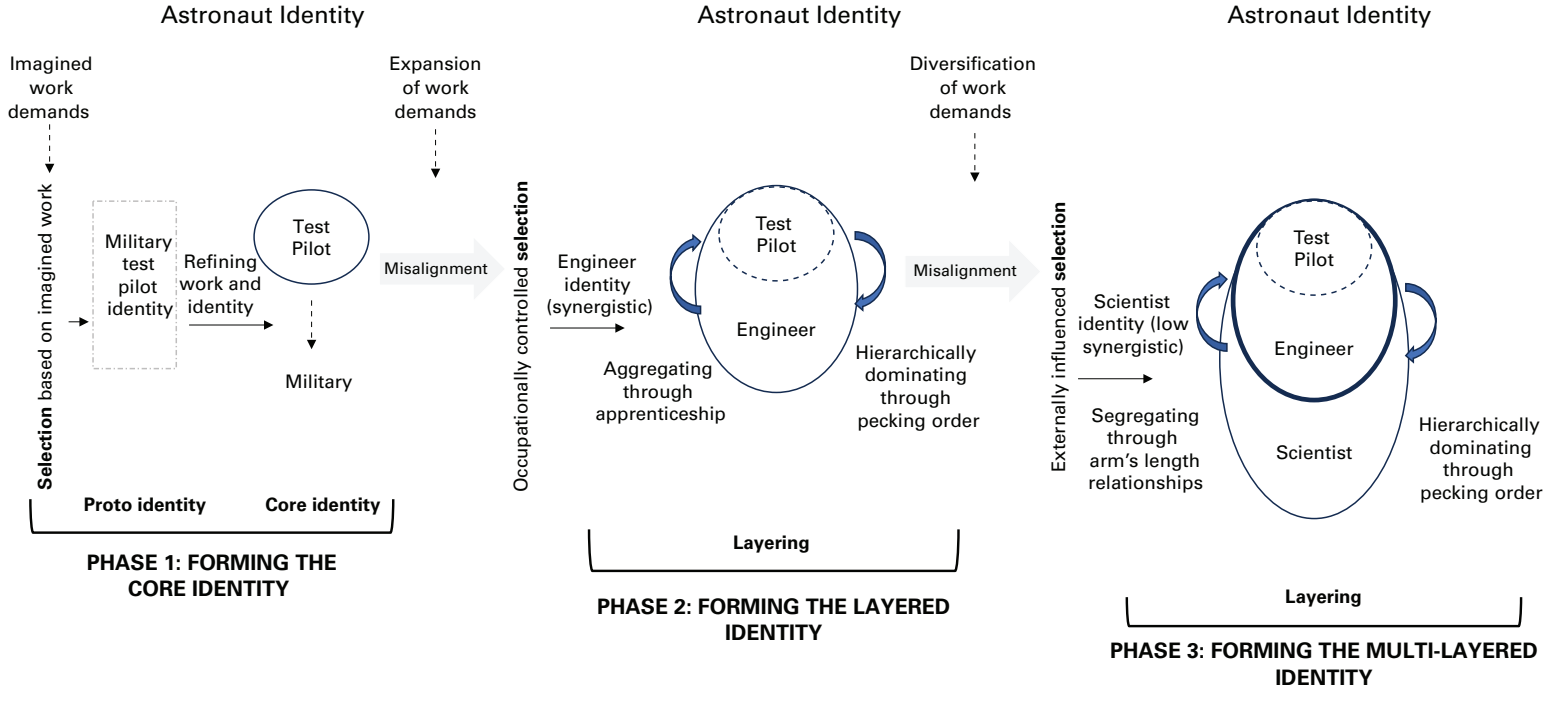
identity. Overall, we saw a cycle in which changing work demands led to the selection and socialization of new members. Moving back and forth between different sources of data, we identified instances in which new identities were perceived as either synergistic or not with the core.

Moving from codes to categories to a model. In our final phase of coding, we took these descriptive codes to create various theoretical categories. In addition to identifying the core identity, for example, we created a new category for identities that emerged over time (e.g., engineer and scientist): accreted identities. We constructed categories around core processes that built on earlier codes regarding expanding or diversifying work (e.g., ''changing work demands'') as well as selection and socialization (e.g., ''occupationally controlled selection'' and ''layering via hierarchical aggregating''). We also created categories around mechanisms that followed from those processes, such as ''work–identity alignment,'' which followed from changing work demands, and ''core–new identity synergy,'' which followed from the (internally or externally controlled) selection (and socialization) of new members. From these categories, we constructed a model of layered accretion, which distills how these categories work together: the core mechanisms (identity–work alignment and core–accreted identity synergy), the layering process (hierarchical aggregation and hierarchical segregation), and the types of identities that emerge over time (proto identity, core identity, latent identity, and accreted identities).

THE LAYERED ACCRETION OF THE AMERICAN ASTRONAUT'S IDENTITY

To present our findings, we draw on the empirical illustration in Figure 1 to show the three temporal phases through which the occupational identity of the astronaut formed. We follow these phases in our explanation below. In Phase I: Forming the Core Identity of the Astronaut as Test Pilot (1958–1963), we describe the astronauts' core identity formation as a process of refining a proto identity imported from a prior occupation through work–identity alignment. The outcome is the definition of a core identity for the new occupation. Specifically, the proto identity of military test pilots was refined by backgrounding the military identity to define the test pilot identity as the core of the new astronaut occupation. In Phase II: Forming a Layered Identity (1963–1969) and Phase III: Forming a Multilayered Identity (1970–1974), two rounds of selection of new astronauts (first pilot engineers and later scientists) introduced new identities into the occupation (engineer and scientist). We illuminate how and why the core identity maintained dominance and how these identities became part of the astronaut identity through the process of layering. We reveal an important variation in how the layering unfolded for the two accreted identities. Identities perceived as synergistic to the core identity (engineer) were aggregated through work and engagement practices that recognized the contribution of these identities; identities perceived as having low synergy with the core identity (scientist) were segregated through work and engagement practices that emphasized their limited contribution. In the following section, we describe these three phases.

Figure 1. Empirical Illustration of the Formation of the Astronaut Occupational Identity



Phase I: Forming the Core Identity of the Astronaut as Test Pilot (1958–1963)

When NASA was established in 1958, its main goal was to reassert the technological and political dominance of the U.S., which had been threatened by the Soviet launch of Sputnik into space a year earlier. This launch led to the development of Project Mercury (1958–1963), the agency's first manned space program. In these early days, NASA wanted to demonstrate whether humans could be flown in space safely; thus, they imagined the work of future astronauts (i.e., imagined work demands) as primarily passive tasks, such as monitoring automated operations, and observing and commenting on both the capsule system and their ''own reaction while in a new, strange environment'' (Project Mercury Familiarization Manual, 1959, p. 17). After much deliberation on who could perform this work best, President Eisenhower mandated that the first astronauts should be selected from military test pilots, as this occupational group was deemed to fit the astronauts' imagined work demands: They were flight trained, accustomed to discipline, and capable of managing potentially dangerous unknowns. Military test pilots were also the only occupational members deemed to have the ''instinct and training required to handle complex spacecraft traveling at high speed and high altitudes'' (Cooper, 2000, p. 10). In these circumstances—a clear mandate for the new occupation and the selection of an occupational group with specific skills—NASA selected active-duty military test pilots as the first group of astronauts in late 1958. The selection process imported the military test pilot identity into the astronaut occupation, effectively making it the proto identity of the new occupation. Upon entering the new occupation, however, the proto identity was revised to form the core identity of the astronaut. In Table 3 we report illustrative evidence of the core identity's formation.

Table 3. Phase I: Forming the Core Identity of the Astronaut (1958–1963): Illustrative Quotations

Identity Formation Process	Quotations
Importing the military test pilot identity as the astronaut proto identity	''I immediately volunteered. I thought that was a natural extension of the test pilot work I'd been doing and sounded like it would be fascinating. So it was mainly because of that background, then, the immediate background, that I thought it was a natural step right on to the astronaut work.'' (Glenn, 1997, p. 6)
	''Test pilots understood the nature of new technologies: going up in hurtling pieces of untested machinery and putting our hides on the line. We knew about hanging it over the edge and pushing back the envelope, then hauling it back in and doing it again tomorrow. When the time came, each of us would take his tum sitting atop the same type of rocket we'd seen blown to smithereens before our eyes. We did so not because we were suicidal or crazed but because we were pilots.'' (Cooper, 2000, p. 4)

(continued)

Table 3. (continued)

Identity Formation Process	Quotations
From proto identity to core identity	**The perceived misalignment between imagined work and proto identity leads to change in work:**
	''We felt we would put man-in-the-loop. We wanted to replace chimpanzees. We wanted to prove we could fly the vehicle, do something that man had never done before, of course. We wanted to be sure we could do it well. We knew the tools we needed. We needed this window so we could make observations out that window to align the spacecraft with the horizon, with the star patterns, with the geographic patterns. We had to make a hand controller, with this right hand, we had to make a pitch, roll, and yaw, and no room for rudder pedals. So a whole new flight control system with our hands rotating back and forth.'' (Schirra, 1998, p. 6)
	''Well, I think that it was an immediate realization that we had essentially a new product. It didn't look very much like an airplane, but if you were going to put a pilot in it was going to have to fly somehow like an airplane, and . . . when you have a . . . strange new machine, then you go to the test pilots. That's what they were trained to do, and that what's they had been doing.'' (Shepherd, 1998, p. 2)
	The backgrounding of the military identity further shapes the core identity:
	''Military people mourn inside, cry inside, bleed inside about losing a compatriot.'' (Schirra, 1998, p. 19)
	''So it was an odd moment around the end of the year when Bob called us all together. 'I know you all want to go first,' he said. 'What I want you to do is vote on which one should be first if you couldn't go yourself. List your choices in order.' It took a moment to sink in that he was asking for a peer vote.'' (Glenn, 1999, p. 232)

Importing the military test pilot identity into the astronaut proto identity. The first group of astronauts (the Mercury Seven), which included Alan Shepard, Gus Grissom, John Glenn, Wally Schirra, Gordon Cooper, Scott Carpenter, and Donald ''Deke'' Slayton, was relatively homogeneous in terms of background and experience: test pilots, White, middle-class American males with strong characters, shaped by years of military training and, in some cases, combat experience. These astronauts perceived their new occupation as a natural extension of military test piloting, as ''the logical extrapolation from what we had been doing all along with airplanes'' (Carpenter et al, 1962, p. 69), with the added excitement of ''pioneering spaceflight'' (Glenn, 1997, p. 6) and novel challenges in control, navigation, and communication.

The newly appointed astronauts carried their prior occupational identity as military test pilots into their new occupation, believing that the features of their prior identity would characterize the new occupation. These features included maintaining composure under pressure, described as having ''ice water in their veins'' (Cernan, 1999, p. 73), the ability to handle unpredictable and high-risk situations, ''any kind of emergency'' (Cooper, 1962, p. 60), and ''to take appropriate action almost by instinct'' (Carpenter et al., 1962, p. 32). One astronaut described this as follows:

> As for me, I considered myself a pretty good stick-and-rudder man. Controlling an aircraft was what I did best in life. Flying came as naturally as breathing and eating to

> me, and if I sometimes acted as if I didn't think anyone could outdo me in the air, well, that's how I felt. Modesty is not the best trait for a fighter pilot. The meek do not inherit the sky. (Cooper, 2000, p. 22)

The astronauts believed that the work of an astronaut would be very similar to that of test pilots, that is, to try out new systems and help perfect them as they went along, as noted in their collective autobiography, *We Seven:* "This is what test pilot is for—to help develop a new system of flight from the ground up and shake the bugs out of it. It is the only profession which is equipped to do this sort of thing" (Carpenter et al., 1962, p. 70). Cooper reflected, "I don't think I felt Mercury was that much riskier than flying a high-performance airplane. I think I felt it was going a little farther, faster, and higher; and certainly, a challenge to be able to get up there" (Cooper, cited in Buckbee & Schirra, 2005, p. 13). They had, as Cooper (in Carpenter et al., 1962, p. 51) put it, "flying in their blood" and a natural inclination toward risk-taking in untested aircrafts. They also harbored a deep desire to be pioneers, seeking both the thrill of exploration and the chance for immortality, an ambition Carpenter (Carpenter et al., 1962, p. 51) described as something he "would willingly give my life for."

The perceived misalignment between imagined work and proto identity leads to the creation of the core identity. As the Mercury Seven commenced their new duties, they realized that the proto identity of military test pilot clashed with the work that NASA had imagined for their new role. According to NASA, the astronaut crew was not expected to actively pilot the capsule or to provide any significant input during the flight operations. The astronaut's role in the Mercury system was, precisely, to be "an aid to system reliability; where feasible, he shall have a backup and override function for all of the major spacecraft system" (Roundup, 1-1-61, p. 2). This expectation was reflected in the design for the Mercury capsules, which minimized the need for human input.

The astronauts, in contrast, perceived being test pilots as core to their identity. The derisive phrase coined by test pilot Chuck Yeager that identified astronauts as "spam in a can" (Wolfe, 1979, p. 60; The Right Stuff, 1983) significantly bothered the astronauts, who (unlike their former colleagues) did not see being an astronaut as fundamentally misaligned with the test pilot identity. Outraged by this mockery, the astronauts were prompted to challenge NASA's initially constrained definition of their responsibilities. When the astronauts began training and preparing for flights, they pushed back on the elements of their work that contrasted with their identity as test pilots. They "wanted to have a chance to be able to fly" (Stafford, 2015, p. 8), and they reasserted this principle in the preparatory activities to the launches. For example, they started "picking at the design" (Schirra, in Carpenter et al., 1962, p. 90) of the early mock-up models developed by the McDonnell Aircraft Corporation, advocating for modifications to the capsule that would provide freedom of navigation, for example windows they could use to determine orientation with the stars:

> It seems that some engineers just don't think the way a pilot does. . . . We all felt that a pilot ought to have a clear visual reference to his surroundings, no matter what kind of a craft he's flying. Otherwise, he would have trouble keeping his bearings and

> maneuvering with real efficiency. We were persistent, and we finally got our way. The engineers built us a window. It was not ready in time for Al Shepard's flight, but Gus's capsule had it, and so did the other capsules after that. (Schirra, in Carpenter et al., 1962, p. 91)

A similar request to change a task to fit their pilot identity involved maneuverability. Astronauts felt very strongly that ''they could develop a technique for flying a lot more than leaving it on partial autopilot or all autopilot'' (Cooper, 1998, p. 12–13). To do so, they requested that thrusters for manual control be included in the capsule design, so they could use them to maneuver the capsule during re-entry.

Most of the changes requested were ultimately accepted. The Mercury Seven astronauts' successful advocacy for modifications can be attributed to several convergent factors that positioned them uniquely within the nascent space program. First, the astronaut's work during the early phases of Project Mercury was very ambiguous, allowing astronauts to actively define what that work should be even though that meant going against NASA's predetermined specifications. In these early days, the imagined work was broadly defined, based largely on a limited set of functions for the astronauts to perform, leaving it somewhat open to interpretation. This ambiguity allowed the Mercury Seven to successfully redefine their role from passive passengers to active pilots with meaningful control over their missions. Furthermore, military test pilot was the sole occupation that had been deemed capable of doing the job. This exclusive selection, combined with the famous stubbornness of the test pilots, amplified their influence within the program. As Schirra noted, ''Humility is not a favorite trait in the world of air and space pilots'' (Schirra, 1988, p. 6). These individuals had very assertive personalities, and their background in experimental aviation had conditioned them to question design decisions and to demand operational control. The unprecedented celebrity status that they had acquired in American society, even before completing their missions in space, also gave them considerable influence, which extended far beyond the space program, with roads and bridges renamed to honor Project Mercury (Roundup, 2-5-61, p. 8), and astronauts were cheered by thousands of people as they paraded around major U.S. cities (Roundup, 1-11-62, p. 1). As national heroes embodying Cold War technological competition, the astronauts wielded public influence that made their concerns difficult for NASA leadership to dismiss.

Backgrounding of the military identity further shapes the core identity. Whereas the test pilot identity drove the change in the astronauts' work, the core identity of the astronaut as test pilot was further refined through backgrounding of the astronauts' former military identity. NASA had intentionally been created as a civilian organization, and transitioning into the agency required astronauts to embrace a civilian orientation. In short, astronaut work was ''civilian'' work. The Mercury Seven put their military careers on hold, did not refer to ranks or military titles, and, in order to work with NASA administrators and engineers, had to embrace a more collaborative attitude than that of the flamboyant pilots they previously were (McDivitt, 1999). However, as we discuss below, this military identity did not disappear and turned out to be extremely influential for the core identity's formation. As Cooper stated, ''I was

a military man who had been assigned to a civilian agency, so I could understand the problems on both sides'' (Carpenter et al., 1962, p. 84). Specifically, the astronauts' military identity fostered a strong sense of camaraderie and mutual trust among the astronauts, even when they disagreed. Indeed, the astronauts recognized that the ''military model did not apply at NASA'' (Glenn, 1999, p. 205) and disagreements needed to be dealt with differently. The astronauts called the sessions in which the astronauts met to discuss such disagreements ''seances,'' and as Glenn (1999, p. 205) explained, ''most of the time we left them with our differences resolved.''

Significantly, the latent military identity profoundly shaped the interactions among astronaut groups. For example, Glenn was ''enormously disappointed and very upset'' when the astronauts were asked for a ''peer vote'' to decide who would be the first astronaut to fly in space; as he recalled, ''the military often used peer votes, but not like this. Months of training were being reduced to a popularity contest'' (Glenn, 1999, p. 232). As military officers, the astronauts maintained deep respect for hierarchical decision-making structures, a concept they referred to as ''pecking order'' (Cooper, 1998, p. 33; Cunningham, 2009, p. 101). Nonetheless, at the end of Phase I, the proto identity of military test pilots imported by the first astronaut group had been revised successfully to establish the new occupation's core identity as test pilots: pilots who test experimental flying machines for civil purposes.

Phase II: Forming a Layered Identity (1963–1969)

The transition from the Mercury program (one-man crew, 1958–1963) to Gemini (two-man crew, 1961–1966) and Apollo (three-man crew, 1968–1970) represented an exponential increase in the scale and complexity of space exploration. The new programs triggered an expansion in work demands and the need for advanced engineering expertise, which created a misalignment between the work needed and the core identity. The original Mercury astronauts did not possess this expertise, and NASA decided to conduct two selection rounds of astronaut cohorts with advanced degrees in engineering. The selection of the pilot engineers led to the engineer identity's entry into the occupation and its subsequent layering on the core identity. In Table 4, we report illustrative evidence of this phase.

Entry of the Engineer Identity

Expansion in work demands leads to misalignment of work–core identity. In 1961, President John F. Kennedy declared before Congress that the U.S. should commit to landing a man on the Moon and returning him safely to Earth before the end of the decade. To achieve this goal, NASA designed a series of space programs that would build on each other as ''steppingstones'' in the ''pathway to the Moon'' (Carton, 2018, p. 342). Unlike Mercury, the Gemini and Apollo programs required astronauts to execute unprecedented, complex tasks, including conducting orbital rendezvous and extravehicular activities and supervising lunar landing systems. These new tasks required advanced engineering knowledge: ''Well, as we got into Mercury, it was more complex. We got into Gemini, and that was more complex. We got into Apollo, it was very, very complex'' (McDivitt, 1999, p. 27). The astronauts who would

Table 4. Phase II: Forming the Layered Identity (1963–1969): Illustrative Quotations

Identity Formation Process	Quotations
Entry of the engineering identity	Expansion in work demands leads to misalignment of work–core identity:
	''The contributions to the Gemini Program by the flight crews have included other aspects than flying the missions. For in addition to training for and flying specific Gemini missions, the crews had engineering and technical assignments to follow through which they presented the pilot's viewpoint in hardware development.'' (Roundup, 6-5-66, p. 3)
	''Over the years, astronauts acquired a mixed reputation among the contractors. Our individual engineering and technical capabilities ran the gamut from good to don't-ask. The Mercury guys were basically test pilots, not exactly enthralled with engineering design details.'' (Cunningham, 2009, p. 71)
	Occupationally controlled selection leads to the accreting of a highly synergistic identity: The engineer:
	''Air Force major Charlie Bassett was probably the best example of these bright, aggressive engineers you were likely to find. Charlie had a BS in electrical engineering from Texas Tech and had been one of the best student test pilots at Edwards. He became a consummate astronaut who could spend hours in the cramped Gemini simulator, 'flying' one demanding rendezvous mission after another.'' (Aldrin, 1989, p. 137)
	''More than anything else, Neil Armstrong loved to fly. Ever since he'd gotten his pilot's license at the age of sixteen, in 1946—before he learned to drive a car—he'd mastered all kinds of flying machines.'' (Chaikin and Bean, 2009, p. 37)
The layering of the engineering identity through hierarchical aggregation	Aggregating the engineer identity into the astronaut identity through apprenticeship:
	''It wasn't until we really got into Gemini that we started working together. Gus was looking after that. So, everybody that had any engineering responsibilities in Gemini always worked with Gus to make sure that it was compatible with the other stuff that was going on.'' (McDivitt, 1999, p. 13)
	''As soon as Gus and I were announced for Gemini III, we flew to the Mc-Donnell plant in St. Louis where our Gemini spacecraft was being built. From there we went on to the Cape to talk to the test and checkout folks . . . Based on what Gus had learned in Mercury and what he contributed to the design of the Gemini cockpit, my commander believed that we had to participate in every aspect of the test and checkout of Gemini III.'' (Young, 2012, p. 68)
	Hierarchically maintaining the dominance of the core identity:
	''Since I was not a test pilot, there were several of us who weren't, we basically figured out real fast that we were at that bottom of the totem pole . . . [G]enerally we were accepted and the lines were accepted, but if you had gone to test pilot school, whether it be Air Force or Navy, you were more accepted than if you were an 'egghead,' so to speak, like I and several others were considered.'' (Anders, 1997, p. 6)
	''We—when we first came, we had ground school-type activity. We were in lectures and learning the phraseology and the business of space, I guess you might say. And then after a short period of time, when the second group had actually been assigned to flights in Gemini, we picked up the things that they were doing. And what they were doing, what that was, that we then took a particular portion of the program—boosters, communications, whatever. I had cockpit controls and displays. So, I had a[n] overall view of things that were going on and what we needed to control particular systems in the vehicle. If we had to—we had the right information and the right switches where we could do that. That was my task, and it was an interim between first becoming acclimated to the community of space and before we became assigned to a flight crew.'' (Gordon, 1999, p. 6–7)

fly to the Moon had to be able not only to fly a spacecraft but also to troubleshoot complex engineering problems. The original Mercury astronauts, despite their capabilities as test pilots, possessed limited formal engineering knowledge. Their expertise lay primarily in aircraft operations and systems evaluation rather than spacecraft design and engineering principles. The Gemini and Apollo programs required more people to complete the ambitious space program that Kennedy's promise had set forth. To bring in the advanced engineering knowledge needed for these complex missions in a short time frame, the NASA Astronaut Office prioritized the selection of engineers in the second and third recruitment cohorts, while maintaining the requirement for pilot expertise.

Occupationally controlled selection leads to importing a synergistic identity: The engineer. The two new cohorts of recruits, the New Nine (Neil Armstrong, Frank Borman, Pete Conrad, Jim Lovell, James McDivitt, Elliot See, Tom Stafford, Ed White, and John Young) and the Fourteen (Buzz Aldrin, William Anders, Charles Bassett, Alan Bean, Eugene Cernan, Roger Chaffee, Michael Collins, Walter Cunningham, Donn Eisele, Theodore Freeman, Richard Gordon, Russell Schweickart, David Scott, and Clifton Williams), included astronauts with advanced degrees in engineering who were working on or had completed a doctoral degree. Pilot experience was still considered essential, while more civilians were accepted, and later, the test pilot qualification was officially waived as a criterion for the Apollo astronauts.[3] These rounds of selection brought the engineer identity into the astronaut group:

> The Mercury guys were basically test pilots, not exactly enthralled with engineering design details. The Gemini group not only had solid test-pilot credentials but also averaged five years of college. Some of them were fine engineers, and they made significant contributions to the spacecraft design. Our Apollo group stood slightly lower than the first two in flying credits but was easily the strongest in technical credentials. (Cunningham, 2009, p. 71)

The engineer identity of the newcomers and the test pilot identity of the incumbents were seen as synergistic by both the Mercury Seven and the new recruits, in the sense that both groups saw that the accreted identity could enhance the core identity's sense of self and valued tasks. There was strong consensus at the time about the type of astronauts that NASA needed. Importantly, the selection of the second and third groups of astronauts was under exclusive control of the Mercury Seven. In fact, during NASA's time of rapid growth (7,966 employees in 1958 to 31,733 in 1969), former astronaut Deke Slayton was appointed Coordinator of Astronaut Activities at the NASA Astronaut Office and became the trusted ''Godfather'' to the astronaut group (Cernan & Davis, 1999, p. 67):

> Deke's appointment as Deputy Director had been (at least partially) a consolation prize bestowed on him by the other Mercury astros when the medics had grounded him. Expecting that Deke would never make a space flight, the Mercury astros

[3] All of the Mercury Seven astronauts were military test pilot school graduates. The New Nine were all military test pilot school graduates except Eliott See, who was the first civilian test pilot. The Fourteen contained mostly test pilots (some with military background), though NASA began to accept a small number of civilian candidates with research/academic profiles.

> relinquished a certain amount of individual autonomy by ''allowing'' him to be in charge. He lacked management experience but started right off running the show. He was successful because he had their respect. He was one of them; he had gone through the same selection process, the same trials. This was no outsider trying to issue orders. (Cunningham, 2009, p. 41)

Newcomers shared the belief that an astronaut had to be, first and foremost, a pilot of the spacecraft and that pilots made ideal astronauts. For example, Borman (1988, p. 155) recalled, ''Flying to me was living, as much a part of me as breathing,'' while Aldrin & McConnell (1989, p. 137) recalled, ''Bassett was probably the best example of bright, aggressive engineer . . . and one of the best student test pilots.'' Even if they were not formally test pilots before becoming astronauts, the characteristics of test pilots remained core to the astronaut identity. As such, new recruits also shared a desire to explore and push boundaries, and they had the same cocky attitude that had characterized the Mercury Seven. Even though the technological complexity of the missions had substantially increased (Roundup, 4-21-65, p. 1), the Gemini and Apollo astronauts expected the pilot to be always in control of the technology, and their engineering skills were considered important support for this task:

> A lot of people think we pressed a button and let the thing fly itself . . . There's no way I'm going to go all the way to the Moon, particularly for a second time, and let a computer land me on the Moon. The arrogance of a pilot, particularly naval aviators, is too great to allow that to happen. Nobody ever landed on the Moon other than with their own two hands and brain and eyeballs and whatever. (Cernan, 2007, p. 2)

The Layering of the Engineer Identity Through Hierarchical Aggregation

As new recruits entered the astronaut occupation, the two identities (core test pilot identity and engineer identity) were simultaneously present in the astronaut occupation. We view the process of bringing together these two identities in terms of hierarchical aggregation, whereby the engineer identity was aggregated into the astronaut identity, while the core identity remained dominant. This process occurred through mentoring of new astronauts and recognizing the synergy between engineering and test piloting.

Aggregating the engineer identity into the astronaut identity through apprenticeship. Upon entering the astronaut group, the pilot engineers began an ''organized training regimen'' (Cunningham, 2009, p. 52) that was intended to prepare them for future missions but also to ingrain the message that their abilities should be used to support the space program while they waited for their chance to fly. The newly selected astronauts were immediately assigned support roles for the upcoming Gemini and Apollo missions and worked closely with the Mercury Seven, who were assigned primary crew roles. Specifically, new recruits were mostly assigned ''engineering responsibilities across both programs [Gemini and Apollo]'' (McDivitt, 1999, p. 12). The Gemini and Apollo programs developed under intense time pressure, and the astronaut group was severely short-staffed. As Armstrong (2001, p. 53) noted, ''we actually had so few people, that almost everybody was assigned all the time. In that period, I

would come off one crew assignment, and within a few weeks I'd be assigned to something else, and that endured throughout the entire Gemini program.''

In this environment of intense work and time pressure, the role of the new recruits was essential because their support in engineering tasks allowed the primary crews to focus on preparing for the mission and piloting the spacecraft. New recruits used their advanced engineering expertise to interact with the contractors and to co-design spacecrafts that, in a context of increasing technological complexity, were consistent with the astronauts' demands to remain in control of the flying experience. Their advanced engineering skills were leveraged as they spent ''a lot of time in the spacecraft doing tests and making inputs to it, changing things'' (Stafford, 2015, p. 111). In the end, as Stafford further noted, the spacecraft ''looked a lot like a fighter plane. . . . Without the crew there, it couldn't fly.'' As Cernan noted,

> We were travelling all over the country helping design and build and test the spacecraft we were going to fly, putting user's input into the development with the engineers at Rockwell, North American, Grumman, wherever it may have been, into everything from the communications systems to the booster systems to whatever to—because we all had an engineering or technical background. So we'd work with them in the design, development, as I say testing, and we could put the user's philosophy into the placement of switches, into what kind of instrumentation we needed from a safety and from a facility and get the job done point of view. We were gone eight days a week. We were gone all the time. (Cernan, 2007, p. 21)

The new recruits also supported the primary crew and the primacy of flying as key astronaut tasks in other ways. First, they leveraged their engineering knowledge to participate in meetings during which decisions were made about the type of assignments that should be included in missions. In those meetings, they represented the astronaut group and protected the astronaut's work by pushing back on proposals by NASA engineers to perform additional tasks that were outside the focus of a piloting mission, for example, requests to demonstrate navigational techniques:

> Some of the people who were working in the Guidance and Control Division at the time thought that that was a wonderful thing to demonstrate, and they thought that the flight of Gemini 10 should be devoted exclusively to demonstrating various new navigational techniques, and they wanted to cancel space walks and anything extraneous to their navigational interest. We, the crew, on the other hand thought that a lot of this was baloney, that the things that they wanted us to investigate would never be used on Apollo, would never be applicable, and were technological dead ends that were perhaps useful for some engineer to give a paper at a symposium, but that really wasn't contributing much at all. So we kind of had a little tension between us. (Collins, 1997, p. 19)

Additionally, new recruits were given the opportunity to ease into the astronauts' work by serving in less-crucial roles and missions. For instance, they were assigned the role of Capsule Communicators (CapCom) for active flights, which immersed them directly in mission operations while keeping them in a supporting position to the primary crews. Through their CapCom duties, incoming astronauts learned the precise communication protocols, emergency procedures, and real-time decision-making processes that were essential to being an astronaut.

Further, when pilot engineer astronauts started to be assigned to missions as primary crew, they did so in less-strategic missions. For example, Borman was assigned as commander of Gemini 7's endurance mission, which involved long-duration spaceflight and was, in his own words, ''not much of a pilot's mission. Just sort of a medical experiment mission'' (Borman, 1999, p. 10).

This apprenticeship model served a dual purpose: By assigning meaningful roles that leveraged astronauts' engineering expertise, the model validated the engineering contribution to the astronaut identity while simultaneously reinforcing the primacy of the test pilot identity. It also ensured that by the time these newer astronauts flew their own missions, they had already internalized the work practices established by the Mercury Seven, having participated in several aspects of mission planning, execution, and post-flight analysis as integral members of the mission teams they supported.

Hierarchically maintaining dominance of the core identity through pecking order. Our analysis also explained why the core identity of test pilot maintained dominance in the astronaut occupation despite the recognition of the important role of pilot engineers. We observed a very strong influence of the latent military identity, whereby the relationships among astronauts were governed by the concept of pecking order, which was, according to Cunningham (2009, p. 107), ''religiously maintained.'' The pecking order manifested as a powerful albeit informal hierarchy primarily based on astronaut seniority, according to which it made a difference ''whether you were first, second, or third generation astro'' (Cunningham, 2009, p. 41). ''We [the Fourteen] were the new guys, the rookies, the bottom of the pecking order'' (Cunningham, 2009, p. 41), while the Mercury Seven were perceived as ''instant celebrities. Lower-case gods. Not so much selected . . . as ordained'' (Cunningham, 2009, p. 23). Cunningham went on to explain:

> The pecking order was derived from several factors but was primarily related to the hierarchy of selection. If one were a Mercury astronaut presumably only God and James Webb enjoyed higher standing—and that might be subject to some discussion. Then came the Gemini group, whose members outranked and overruled all the weenies and plebes behind them, meaning us, the Apollo astronauts. That pecking order prevailed throughout the system. In fact, it was the system. (Cunningham, 2009, p. 101)

The way astronauts exerted the pecking order was by retaining control over key decisions that preserved and perpetuated the centrality of the test pilot identity. Notably, these decisions regarded the selection of astronauts to be assigned to the most important component of astronauts' job, i.e., the primary crew in missions. With former Mercury Seven astronauts Slayton and Shepard now holding leadership positions in the Astronaut Office and being responsible for assigning primary and backup crews for the Gemini and Apollo missions, the test pilot background was always prioritized. Slayton ensured that test pilots kept commander roles, while assigning engineering tasks to less-experienced astronauts:

> In my tentative crew plans carrying through the last Gemini missions into Apollo, I figured it would be the test pilots I would count on for the more immediately difficult work-training as command module pilots for future Apollo missions, where they

> would, in effect, be solo pilots. The more engineering and research guys would get their chance, too, but on the development end of things. (Slayton, 1994, p. 134)

Pilot engineer astronauts also contributed to retaining the test pilot core identity through their acceptance of this pecking order. They explained how they were moved by a profound sense of obedience and respect toward earlier astronauts: ''These guys were our heroes of the space age, and I basked at being admitted to their presence'' (Cernan & Davis, 1999, p. 57). Furthermore, they accepted decisions about assignments without question. Even when disappointed with their assignments, they internalized their frustrations rather than voicing them, so as not to compromise the possibility of being chosen for future missions. As Cunningham (2009, p. 99) noted, ''Each of us was learning how to play the space game.''

The result was general acceptance of the new recruits as valuable and deserving members of the astronauts group. As Lovell (1999, p. 8) noted, ''You know these were the days when . . . they were pretty high on the totem pole; they were muckety-mucks. They were well known and everything like that. And the nine of us walk in there. But they warmed up after a while.'' While the old guard of Mercury astronauts ensured that new entrants never eroded their primacy and influence, they conceded that engineer astronauts had contributed substantially to the program's success.

By the end of Phase II, the astronaut group's occupational identity had transitioned from the initial core identity of test pilot to a layered identity of test pilot and engineer, with a perceived strong synergy between them. Although the test pilot identity remained at the top of the totem pole, the fast pace of technological progress and the complexity of work demands had enabled the engineer identity to enter the occupation. Different cohorts of astronauts agreed that the engineer identity was synergistic to the core identity, and the layering through hierarchical aggregation allowed the accreted engineer identity to become part of the astronaut occupation.

Phase III: Forming a Multilayered Identity (1970–1974)

In 1969, the sociopolitical context of the space program changed dramatically. After more than two billion spectators watched the triumph of the Apollo 11 lunar landing, ''the Space Race was over'' (NASA: The Complete Story, 2008), and support for space exploration began to wane. ''The lack of media interest, which was translated into a lack of political interest in the country'' (Schmitt, 2000, p. 3), raised concerns in the U.S. Congress about the value of continuing to fund expensive and risky space missions. Amid a new era of scarce resources and political turmoil, NASA shifted its focus from ''space exploration'' to ''space exploitation'' to demonstrate to ''taxpayers what space can do for them'' (NASA: The Complete Story, 2008). The diversification of work demands led to another instance of misalignment between the layered identity that now defined the astronaut occupation and the work needed. Having partially lost full autonomy to the scientific community over selection, the astronauts were forced to recruit new cohorts with scientific expertise. The selection of scientists led to the scientist identity's entry into the occupation and its layering on to the astronauts' identity. In Table 5 we report illustrative evidence of how the astronauts' multilayered identity formed.

Table 5. Phase III: Forming the Multilayered Identity (1970–1974): Illustrative Quotations

Identity Formation Process	Quotations
Entry of the scientist identity	Diversification of work demands leads to layered identity–work misalignment:
	''I hope the history shows that there are two very different agendas that somehow found themselves on Apollo. One was to take an American to the Moon and return him safely. That was one agenda. And the other agenda, unwritten and uncommitted to, but kind of adopted increasingly as the missions unfolded, was a scientific agenda. . . . and you realize that these [two agendas are] mutually perpendicular, or maybe they're opposed to each other.'' (Allen, 2003, p. 24)
	''But we had a lot of geology field trips, trying to become good lunar geology observers. Once we got on the Moon what they wanted us to do was recognize something that was unusual, and take pictures, examine it, bring a sample, look around the corner, drive over the top of the hill or wherever it was to make the time we had on the Moon useful time.'' (Cernan, 2007, p. 20)
	Externally influenced selection leads to the accreting of a low-synergistic identity: The scientist:
	''The National Academy of Sciences, strongly recommended to NASA that some of the people who go to the Moon and participate in these scientific missions should have genuine scientific backgrounds and not be test pilots. NASA thought about that for a while, thinking, 'This is a highly technical, highly risky, test-piloting program. We're not sure we can afford to carry scientists who aren't pilots along,' but they finally agreed that they would hire some scientists, train them to be pilots, so that they could do the piloting jobs as well, at least in an assistant mode, and carried on like that.'' (Kerwin, 2000, p. 4–5)
	''Neal: I guess that's the difference between the people who will fly in the International Space Station, too, isn't it? They're not really going up there to be pilots. They're going up there to be scientists, engineers . . . Schirra: To do work. Sure. I think it would be a crime to have a pilot go up there and sit around for months at a time. In fact, you haven't seen many do that, if you look at it. And most of those who have been up there for a long time left NASA in a hurry, I've noticed that, too. So you've got to select people who are willing to stay in that dumb environment for that long. You can't eat out. [chuckles] And the entertainment is pretty limited. So I would say you'd have to be a totally different kind of person than a hotshot fighter pilot. That's essentially what I thought I am.'' (Schirra, 1998, p. 31)
Layering of the scientist identity through hierarchical segregation	Segregating the scientist identity into the astronaut identity through arm's length relationships:
	''The test pilots were always there first, a natural extrapolation of test flight, so it was natural that that's the way it was. But it did take a while in order to break down those barriers, and it was just working alongside the guys and finally it happened.'' (Gibson, 2000, p. 13)
	''At any rate, these six of us were then put in a position where we had to qualify as pilots. As everybody should know, everybody in the Apollo spacecraft really needed to operate as a pilot-astronaut as well as whatever else they might have been in their previous life.'' (Schmitt, 1999, p. 6)
	Hierarchically maintaining the dominance of the core identity:
	''The specialists have important duties to perform, but they should not be confused with pilots. Nor should people who don't fly the spacecraft be called astronauts.'' (Schirra, 1988, p. 53–54)
	''Well, we thought naively that Houston just couldn't wait to get us back there because we were so vital to the space program. So we showed up back here at Johnson Space Center, and it was, you know, 'Hey, boy, bring the stool over here.' We were not regarded as really instrumental to what was going on; that's an understatement.'' (Gibson, 2000, p. 12)

Entry of the Scientist Identity

Diversification of work demands leads to layered identity–work misalignment. The need to refocus the space program on advancing science intensified pressure to diversify the astronauts' work to include conducting complex scientific experiments. The remaining Apollo flights (12, 14, 15, 16, and 17) and the Skylab program concentrated on scientific research, requiring astronauts to perform experiments from the Apollo Lunar Surface Experiments Package, medical studies on human adaptability to zero gravity, solar observations, and detailed Earth resource assessments (Roundup, 8-21-69, p. 1).

Astronauts traditionally had regarded the execution of scientific and technical experiments as ancillary (at best) to piloting and as highly distracting. In the words of Cunningham (2009, p. 94), ''Both Gus [Grissom] and Wally [Schirra] considered anything scientific as junk.'' In the early days of the space program, doctors and other scientists had urged astronauts to perform scientific experiments while on board spacecraft during missions. However, these requests had consistently been met with fierce resistance. Astronauts argued that ''You couldn't overload the astronaut with a lot of observations and experiments and expect him to do his best job flying the spacecraft'' (Slayton, 1994, p. 120). These tasks were perceived as a markedly different set of activities that did not align with the astronauts' identity as test pilots and engineers. As Cernan stated, ''We didn't want to be known as scientists'' (Cernan & Davis, 1999, p. 70).

Externally influenced selection leads to importing a low-synergistic identity: The scientist. The astronauts' leadership team, led by Slayton and Shepard, was ultimately compelled to accommodate external pressures from the National Academy of Sciences, which had persistently advocated during the Gemini and Apollo missions for the inclusion of scientists in the program (Schmitt, 1999). For the first time, astronauts had to partially relinquish control over the selection process, allowing two groups of scientists to enter the occupation. The first group of selected candidates, collectively referred to as ''the Scientists,'' included Owen Garriott (electrical engineering and physics), Edward Gibson (aerospace engineering, physics, and astronomy), Curtis Michel (physics and astronomy), Harrison Schmitt (geology), Joseph Kerwin (medicine), and Duane Graveline (medicine). This was the first cohort chosen primarily for their research and academic expertise rather than for prior flight experience, which was either absent or minimal. In August 1967, amid the Apollo program's peak development, NASA selected a second group of scientist astronauts (the ''X-11''), which included physicians, physicists, engineers, and other specialists.

Unlike the engineer identity, the scientist identity was perceived as having very low synergy with the astronaut identity, as it provided little or no support to enacting the test pilot's sense of self and to affirming the astronaut's core tasks. Exempt from piloting requirements prior to selection, scientists did not consider flying as the core task of the astronaut as much as the Mercury, Gemini, and Apollo astronauts did. Incumbent astronauts regarded scientists as ''another form of life'' (Gibson, 2000, p. 13) as they did not embody the core pilot identity based on a risk-taking attitude, strong instinct, and pioneering

ambition. Furthermore, this integration was seen as a politically driven imposition whereby NASA had bowed to the Academy of Sciences amid post-Apollo funding shortages. The scientist astronauts were not ''entirely welcome'' because ''it seemed to us as though NASA was caving into the scientific community, bargaining for dollars and support by promising a ride for some guy toting test tubes'' (Cernan & Davis, 1999, p. 84). The rest of the astronaut corps displayed ''cool hostility'' and a ''lot of lack of acceptance'' (Gibson, 2000, p. 13) toward the scientist groups. And the scientists shared this view to some degree. Reflecting on early days, Gibson (2000, p. 8–9) commented, ''I was just really a kid thrown right in the middle of that. It was the glory days of the Mercury, the Original Seven, and then the next group, the Gemini Program was still on. And all of a sudden to be brought in with that group, I felt like an imposter.''

In elaborating on this perceived lack of synergy, he explained, ''It was strictly a belief. These guys grew up in a test pilot world. We grew up in a science world'' (Gibson, 2000, p. 14). This marked difference illuminates how the accreted scientist identity, unlike the engineer one, did not reinforce the pilots' sense of self or enhance the task of piloting and flying.

Layering of Scientist Identity Through Hierarchical Segregation

With the advent of the scientist identity, the identity formation process of the astronaut occupation unfolded in a second round of layering. The accreted scientist identity became part of the astronaut occupational identity, but it remained subordinated to the core identity through what we call layering by hierarchical segregation.

Segregating the scientist identity through arm's-length relationships.

The pilot engineers had entered the program when the astronaut group was relatively small, and they were ultimately accepted because similar piloting backgrounds and experiences created strong group cohesion. The scientist astronauts faced a fundamentally different socialization process and engagement with prior cohorts that resulted in what can be characterized as ''segregation,'' to denote that this identity was included but kept meaningfully separated from the others and was peripheral to the core occupational identity.

Formally, to facilitate their inclusion in the astronaut group, new entrants were forced to undergo 52 weeks of jet pilot training. Flight school emphasized operational skills that were peripheral to the scientists' academic expertise. The flight school requirement implicitly suggested that scientific expertise alone was insufficient for astronaut status and that scientist astronauts had to prove they could master the pilot-centric skills that defined traditional astronauts' competence. Indeed, the incumbent astronauts argued that it would be dangerous to include scientists in missions without proper flight training, believing the scientists would think ''The guys in the control room would bail us out'' (Cernan & Davis, 1999, p. 331). This requirement reflected their assumption that no matter how automatic a system could be, ''A human being was in the loop, which requires an intensive amount of understanding and background and knowledge'' (Cernan, 2007, p. 17). New recruits largely accepted these conditions as a prerequisite for inclusion in the astronaut program and the

opportunity to fly in space. Garriott (2000, p. 8), for example, explained, ''Of course, even though we didn't aspire to be a world-class test pilot, we did want to be able to fly aircraft, and we considered ourselves capable of flying jets in the same way that they flew around Houston there.''

However, rather than serving as an equalizer, flight training became a source of tension. For many scientist astronauts, flying meant starting from scratch in an area that was central to astronaut identity but professionally secondary to their scientific contributions. This requirement positioned them as perpetual newcomers rather than equal contributors with different but valuable expertise. Some even argued that the astronaut group used this maneuver to boycott the scientists. Cunningham (2009, p. 296), noted, ''There was no way that the scientists would be shut out of the space odyssey,'' so the astronauts made sure that the scientists would have to compete at the same levels as trained pilots did in order to have a role in upcoming missions, which made the scientists much less likely to succeed. The scientists knew that this was an unreachable bar. They commented that they received ''Second-class kind of pilot training'' (Kerwin, 2000, p. 5) and that ''The old pros naturally assumed they would not be able to cut the mustard with the aviator fellows'' (Cunningham, 2009, p. 106). Gibson (2000, p. 12) assumed ''That maybe they sent us off to flight school hoping we would quickly flunk out or kill ourselves, or, anyway, not show up back here . . .''

Additionally, unlike pilot engineers in the prior layering, whose advanced skills were considered and had proven to be synergistic and extremely valuable for space missions, the scientists' disparate academic expertise (e.g., medicine, astronomy, physics, geology, etc.) was considered ancillary, if not superfluous, to space missions. Moreover, when medical or scientific work (e.g., Borman's endurance test, gathering rocks) was required in earlier missions, non-scientist astronauts had been able to perform the tasks. The extended period required for flight training meant that scientist astronauts were removed from their research environments and scientific networks. This reinforced the message to the newcomers that if they wanted to belong, scientific interests had to be ''merged and subordinated to those of the program'' (Kerwin, 2000, p. 6). It was their responsibility to figure out how to make their scientific expertise valuable to the space program and the other astronauts.

Many scientist astronauts experienced ongoing tension between their scientific identities and their astronaut roles. Some scientists maintained a supporting role, performing basic science training for the other astronauts, as in the case of Schmitt. Another scientist, Joseph Allen (2003, p. 14), created a liaison role for himself: ''I found myself being very good at translation. In this case, it was translating what the scientists wanted to the test pilot astronauts, and what the test pilot astronauts needed to the scientists who didn't understand that.'' Similarly, Kerwin, a doctor by training, was able to use his expertise in service of the life support systems. In contrast, other members of the two groups of scientist astronauts had a more challenging experience integrating their academic expertise into their astronaut role. Curt Michel, for instance, was a ''paper-and-pencil astronomer [and] was not so well accepted'' (Kerwin, 2000, p. 6). For those scientists, the socialization process never fully resolved this conflict, leading some to eventually return to research careers; Michel left NASA in 1969, without having flown in space, to continue research in space physics at Rice University.

Overall, efforts to formally include scientists while maintaining an arm's-length relationship with them resulted in the scientist identity's delineation as distinct from the other identities of test pilot and engineer. Scientists came to recognize that their contributions to the occupation were limited, leading to a process of self-selection among those willing to occupy such a position.

Hierarchically maintaining the core identity's dominance through the pecking order. Despite the influx of newcomers and a revised scientific mission, the pecking order maintained the core test pilot identity in a hierarchically superior position. Former military test pilot astronauts continued to occupy leadership positions in the Astronaut Office and made critical decisions about crew assignments. After Slayton, Shepard (Mercury Seven) served as Chief of the Astronaut Office from 1963–1969, while James McDivitt (the New Nine) later managed lunar landing operations and Apollo spacecraft programs for missions 12–16. Test pilots held key leadership positions in the missions, while scientist astronauts were often relegated to specialized scientific roles, rather than holding command positions. Their expertise was allowed but within narrow confines that did not threaten the existing hierarchy. Slayton's conversation with Allen and other XS-11 members in 1968 provides a telling example: ''We do have a lot of work to be done, and if you want to work in the space program, there's a lot of very useful things to be done, and we will give you assignments. But don't fool yourself into thinking you're going to be space flyers'' (Allen, 2003, p. 8–9). The pilot–scientist divide remained pronounced, and Slayton never hesitated to relieve scientists of their astronaut duties when they challenged his leadership:

> I had some attrition in the Astronaut Office that spring and summer [1968]. The most public was one of the 1967 group of scientists [*the second group of scientists recruited*], Brian O'Leary . . . We had already been confronted with some public bitching by the scientist-astronauts, notably Phil Chapman of the new group, and Curt from the 1965 selection. They realized they weren't getting any time to do research and were spending it all traveling around the country learning what NASA did and sitting through lectures on the Apollo spacecraft. We let Michel go ahead and start spending most of his time at Rice University doing research. It was basically his first step out the door. A couple of years later he [O'Leary] published a book called The Making of an Ex-Astronaut, which pretty much confirmed my impressions. As far as I was concerned, he never was an astronaut. Until the scientist astronauts finished flight school, they were only candidates as far as I was concerned. (Slayton, 1994, p. 211)

By the end of Phase III, a low-synergy scientist identity had been layered on to the broader astronaut identity consisting of the test pilot and engineer identities. The three identities of test pilot, engineer, and scientist were layered in a hierarchical fashion, while the core identity of test pilot retained dominance in defining the astronaut occupation's identity. Layering by hierarchical aggregation of the engineer identity allowed the occupation to realign work demands and identities by incorporating advanced engineering skills into the occupation. Layering by hierarchical segregation allowed the inclusion of the scientists. The presence of multiple identities persisted beyond the Apollo era. In the Shuttle program, for example, astronauts with a piloting background took the role of

flight commanders, whereas scientist astronauts performed experiments (Schmitt, 1999, p. 35). The latent military identity also continues to show remarkable endurance in the selection of modern astronaut cohorts. In the 2021 Artemis cohort of new NASA recruits scheduled to fly to the Moon, for example, seven of the ten astronauts have a military background (U.S. Navy, Marines, and Air Force), extensive pilot training, and advanced engineering degrees, and the other three have a doctorate in STEM fields (engineering and physics).[4]

DISCUSSION

While existing research has largely concentrated on differentiation as a key mechanism of identity formation for emerging occupations in saturated spaces (Abbott, 1988; Bucher & Strauss, 1961; Sherman, 2010), we suggest that the overemphasis on occupational jurisdiction dynamics may have obscured other important dynamics. We focused on the process of identity formation of occupations, like that of the astronaut, that emerge in unsaturated spaces in which occupational members experience minimal inter-occupational competition, are not driven by the quest for legitimacy, and do not articulate their identity by differentiating from existing occupations. Our work extends a growing body of recent scholarship highlighting how some occupations, especially those arising from external mandates (Augustine, 2021; Augustine et al., 2025; Johnston, 2011; Lounsbury, 2001), experience limited inter-occupational competition during their early development, but that scholarship has not focused much on theoretical puzzles pertaining to these occupational identities.

Drawing on the case of the American astronaut, we advance current understanding of how the occupational identity of emerging occupations forms through an intra-occupational process of layered accretion. Through this process, a core identity is formed, additional identities are brought into the occupation, and those accreted identities become part of the forming occupational identity through their layering on to the core identity. Figure 2 shows our model.

At the occupation's inception, its identity is based on a proto identity, that is, the imported occupational identity of the individuals who originally fill the occupational vacancy. This proto identity may or may not fit the initial or imagined work that needs to be done by the new occupational members because the new occupation's work is often ambiguous and still vaguely defined in the early stages of formation (Bucher, 1988; Fayard et al., 2017; Murphy & Kreiner, 2020). The proto identity is then transformed into a core identity via a process reconciling the proto identity with the imagined work (work–identity alignment). As the new occupation begins to form, changes in work demands spark new questions about whether the core identity (who we are) defined by early members aligns with the new work demands (what we need to do). If there is misalignment, new members' entry into the occupation represents an opportunity to address the new work demands, as new members typically bring their own occupational identities (DiBenigno, 2022; Ibarra, 1999; Van Maanen & Schein, 1979). Labeling the outcome of importing additional identities into the

[4] https://www.nasa.gov/news-release/nasa-selects-new-astronaut-recruits-to-train-for-future-missions/

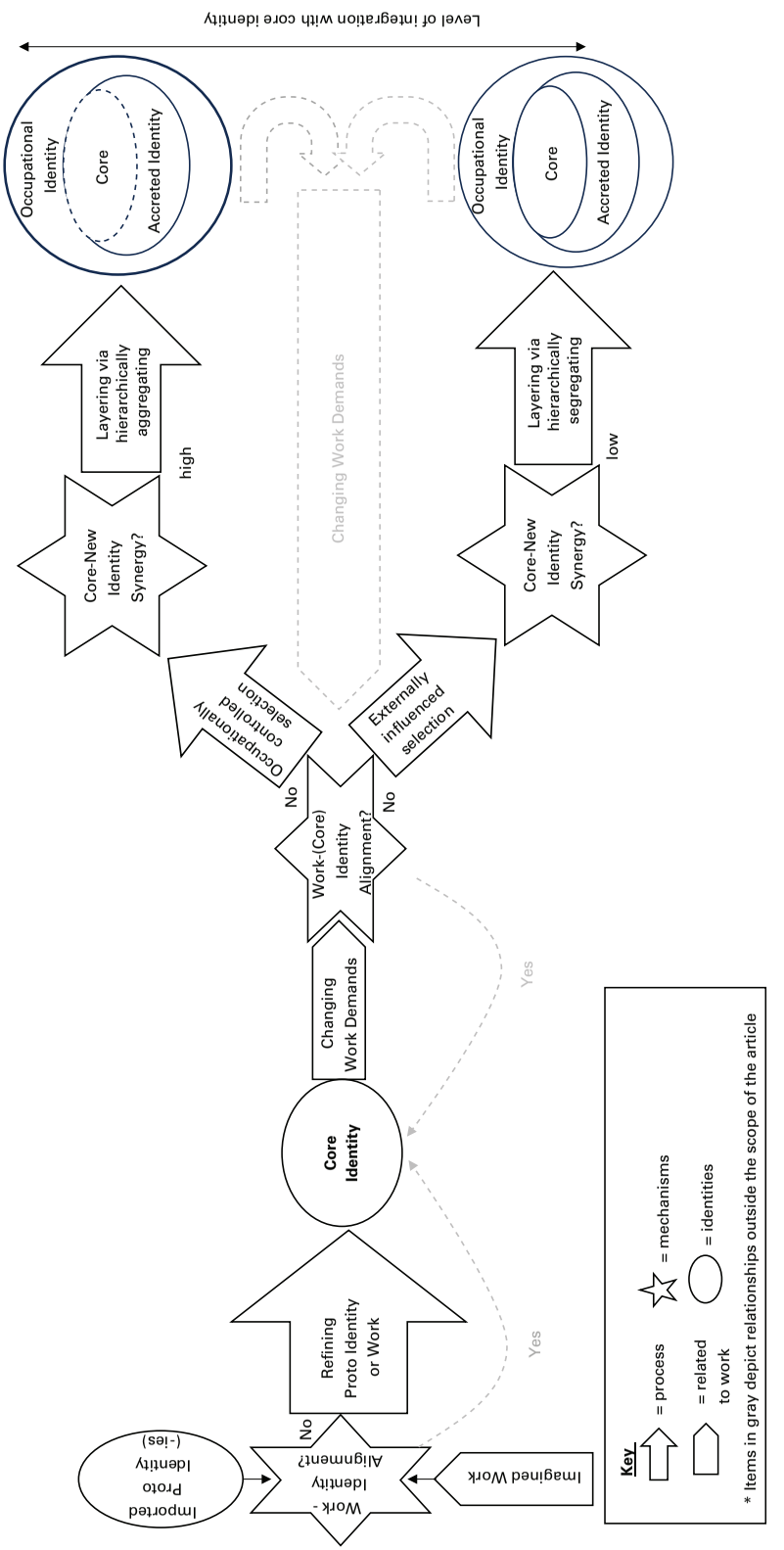
occupation as ''accretion,'' we found that occupations' degree of control over which new identities are added to the core varies depending on whether the selection process is occupationally controlled (the occupation retains primary control over selection choices) or externally influenced (the occupation retains partial control over selection choices). Once the accreted identities are brought into the occupation to deliver on new work demands, they interact with the core identity. The degree of perceived synergy of the core identity with the accreted identities (core–accreted identity synergy) shapes the type of layering. Accreted identities are either hierarchically aggregated on to or hierarchically segregated from the core identity depending on whether the synergy is high or low. As shown in Figure 2, the process is iterative as further changes in work demands can spark new iterations.

A Model of Identity Formation: Process, Mechanisms, and Multiple Identities

Our study makes key contributions to the literature on occupational identity and emerging occupations by theorizing occupational identity formation in unsaturated spaces. Specifically, we theorize the process of layered accretion as a new way of occupational identity formation; the mechanisms that underlie this process; and how multiple identities interact in this process. In theorizing this new process, we discuss how it aligns and builds on extant understandings of how occupational identities form, and we identify new areas for research.

The process of layered accretion. Our model (Figure 2) conceptualizes occupational identity formation as a dynamic, relational, and iterative process wherein ongoing negotiations occur between newly imported identities, which are brought by selected members from other occupations who can address changing work demands, and the established core identity. The transformative dimension of this model lies in its recognition that accretion of identity and layering can repeat cyclically over time. Each successive cohort of occupational members may introduce additional identities that require evaluation and potential integration with the existing core identity. This continuous dialogue between accreted and core identities generates productive tension, as the core identity is simultaneously reinforced and refined through successive encounters with imported identities. The iterative nature of this process means that the core identity serves as both an anchor and evolving reference point, maintaining stability while accommodating change. In essence, we theorize that core identities fulfill a crucial stabilizing function in unsaturated occupational spaces by providing an anchor for collective understanding of ''who we are,'' which is particularly vital when technologies, regulations, and other external forces trigger changes in the occupation. Our work builds on and extends the scholarly tradition that theorizes identity formation as an inherently relational process between a self and another comparative referent (Abbott, 1988; Clegg et al., 2007; Murphy & Kreiner, 2020). Prior research has considered other occupations as the comparative referent (Abbott, 1988; Anteby et al. 2016; Bucher & Strauss, 1961; Fayard et al., 2017; Hughes, 1958). By contrast, in our theory, the core identity serves as the comparative referent for occupational identity formation in unsaturated spaces.

Figure 2. A Model of Occupational Identity Formation in Unsaturated Spaces Through Layered Accretion



Our study also shows that accretion is strongly influenced by selection and by an occupation's ability to control this process (Abbott, 1988; Bucher & Strauss, 1961). In identity formation terms, we theorize that the degree of control exercised by existing occupational members over selection processes serves as a critical predictor of synergy between core and accreted identities. Occupationally controlled selection likely imports identities that align with the core identity, reflecting the occupation's capacity to maintain coherence through gatekeeping (Freidson, 1984). This represents an established perspective in occupational sociology, whereby professional groups actively shape their composition through credentialing, training, and recruitment practices (Abbott, 1988; Collins, 1979; Freidson, 1986; Larson, 1977). However, our model distinguishes occupationally controlled and externally influenced selection by showing that the scientist identity was brought into the occupation when the Academy of Science influenced selection. This insight supports contemporary research highlighting the increased influence of external organizations over new occupations (Alvesson & Willmott, 2002; Gorman & Vallas, 2020; Simpson, 1985). When organizational and occupational imperatives diverge, as they frequently do, tensions emerge (DiBenigno, 2018; Sorensen & Sorensen, 1974; Truelove & Kellogg, 2016). We extend these insights to establish a conceptual link between selection criteria and identity synergy; in cases of limited occupational control over newcomer selection, which we call externally influenced selection, accreted identities (i.e., scientist) are more likely to be perceived as poorly synergistic with the core identity (i.e., test pilots).

Beyond accretion, our theorization of layering as a key process in the formation of complex identities is an important extension of the current literature on occupational emergence. Systematic studies suggest that there are various ways in which occupational identities can form. Nelsen and Barley (1997), for instance, suggested that the contestation between voluntary and professional EMTs would eventually lead to the dominance of the professional EMTs and the exclusion of volunteer EMTs. To our knowledge, this has not happened, and we do not know much about how the identity of the occupation has unfolded over time. By contrast, merger is the dynamic hinted at by Elias (1950) in a study of the naval officer occupation, in which the two competing occupational groups with distinctive identities (sea men and gentlemen) eventually merged when a combined training system allowed the reconciliation of both sets of skills and identities into a unified occupational role. Layering offers an intermediate outcome between sustained competition and identity merger, whereby the plurality of occupational identities is retained but their hierarchical position is clearly defined and accepted.

Mechanisms of layered accretion. A second contribution is the delineation of how mechanisms of identity formation in unsaturated spaces are distinct from those underpinning inter-occupational comparisons. We identify two mechanisms that drive the process: proto or core identity–work (imagined or real) alignment and core–accreted identity synergy. Questions about work–identity alignment are critical at multiple levels of analysis, whether looking at individual adoption of occupational identities (DiBenigno, 2022; Pratt et al., 2006) or at occupational identities collectively (Nelson & Irwin, 2014).

In most cases, when identity and work misalign, identities change. To illustrate, because the occupations investigated in prior studies are highly institutionalized and the occupations' work demands are relatively set, research suggests that individuals entering an occupation will typically align their identities with work demands (Becker, 1961; Chen & Reay, 2021; Pratt et al., 2006; Van Maanen & Schein, 1979).[5] For new occupations emerging in saturated spaces, work demands are also somewhat set or constrained by the occupation(s) already occupying the jurisdictional space. Members of new occupations perceive a strong urge to demonstrate distinctiveness in expertise, practices, or ethos, while signaling alignment with the industry's work demands. Research shows that new occupations form a distinctive identity around unique expertise, practices, or ethos but are also careful to maintain enough conformity to signal their legitimacy and ability to address the same work demands of existing occupations (Murphy & Kreiner, 2020; Vaast & Pinsonneault, 2021).

Our study expands understanding of identity–work alignment in important ways. In unsaturated spaces, the lack of strong occupational jurisdiction makes the often unidirectional changes from misalignment (i.e., identity follows work demands) more dynamic. As illustrated in Figure 2, identity formation at the occupation's collective level can occur both by altering the work incompatible with the emergent occupational identity and by triggering the importing of new identities when such work demands cannot be rolled back. We theorize how identity–work alignment acts as a driver of collective-level occupational identity evolution, whereby imagined work becomes real over time and occupational identities move from relatively simple to more complex. In our case, NASA envisioned the astronaut work as military test pilots being passengers in a space capsule, which was misaligned with their test pilot identity. In response, astronauts pushed for changes in work practices to ensure they could transfer their proto identity of test pilots to their missions in a spacecraft. At the same time, they refined their proto identity into the core one by backgrounding the military component to fit the civilian work of NASA. Thus, both work and identity changed.

Comparing our findings with prior studies, such as those on sustainability managers (Augustine, 2021) or occupational program consultants (Blum et al., 1988), we can probe deeper into conditions that may further influence the outcome of this initial work–identity alignment. The first condition is the amount of control held by occupational members selected to fill the occupational vacancy vis-à-vis external forces, such as other occupations, structural constraints, or technological demands. The second condition is the degree of ambiguity in the work itself, which is typically higher in the early stages of occupational emergence. Even though in unsaturated spaces inter-occupational competition is not a salient driver of identity formation, and work demands are more likely to be worked out through interactions with the forming identity, occupational members may be more or less in control of shaping the work–identity relationship. If occupational members are relatively less in control in the face of external forces and work is defined as having low ambiguity (e.g., a clear external mandate such as that for nuclear scientists), we would expect conformity to the

[5] Professional identities may not adapt to the demands of the work environment when such demands threaten idealized occupational identities and professionals can positively verify such identities in specific client interactions (DiBenigno, 2022).

imagined work to determine the core identity's formation. This is what happened in the case of the Russian cosmonaut program: Despite having selected the pilots, the Russian space program conceptualized and designed space travel as an entirely automated endeavor; new occupational members had little latitude to change the imagined work of being a passenger in a space capsule, and their proto identity of test pilots was subjugated to their mandated role as passengers (Cernan, 2007). In contrast, the exclusive selection of military test pilots as the ideal occupation from which American astronauts should be chosen gave occupational members much latitude to shape work that was still sufficiently ambiguous. In these circumstances, work is more likely to change to fit the proto identity. Finally, if occupational members populating the new occupation have limited assertiveness vis-à-vis the external mandate they are given and if the work is ambiguous, as in the case of sustainability managers, then the identity of the occupation will form around standardized practices. As the sustainability manager occupation became more assertive in embracing more radical elements of the identity, occupational members secretly attempted to align work with their identity by engaging in what Augustine (2021, p. 1073) referred to as ''insurgency work.''

Furthermore, we show that the mechanism of work–identity alignment explains how and why new identities may enter the occupation and accrete on to the core identity. When technological developments (Orchard & Tasiemski, 2023; Vaast et al., 2013) or sociocultural changes (Risi & Wickert, 2017) trigger changes in occupations' work demands, questions about alignment rekindle. Two outcomes can follow from the comparison of a core identity to changing work demands. First, changes in work demands may not make appreciable differences to the core identity, and consequently, occupational members may continue to view the new demands as aligned with their core identity (see the second gray arrow in Figure 2). For example, Vaughan's (2021) ethnographic study of air traffic controllers showed that controllers continued to frame their identity around their interpretive skills and judgment even in the face of changing technological interfaces and political shocks to the occupation. When a misalignment is perceived, however, new identities are imported into an existing occupation, and the issue arises of how they will interact with the core identity.

When new identities are accreted, the second comparative mechanism intervenes, in which the synergy between the core identity and the accreted identities is evaluated. In broad terms, identity synergy may refer to overlap in values (Pratt & Foreman, 2000) or, in occupations, may be related to similarities or alignment in ''what we do.'' In our analysis, we showed that synergy refers to the extent to which the accreted identity is perceived as enhancing the core identity's enactment and as reinforcing identification of which tasks define the occupation. Identity synergy allows smoother integration of accreted identities into the occupation, whereas identities perceived as not synergistic will be included with some tension (see Figure 2). The mechanism of core–accreted identity synergy opens possibilities for different modes of managing multiple identities in subsequent layering.

The layering of multiple identities. A third important insight of our model is the idea that identity formation in a new occupation may entail understanding how multiple identities interact with one another and how they are potentially

managed within the same occupation. Prior research has typically focused on the individual level (Caza et al., 2018; Ramarajan & Reid, 2013; Ramarajan & Yen, 2024) or examined organizational identities across levels (Pratt & Foreman, 2000). Our work breaks new ground by theorizing multiple identities management at the level of the occupation. The two layering processes identified in the model, hierarchical aggregating and hierarchical segregating, have a common theoretical feature that explains why layering occurs vis-à-vis alternative paths such as merging or selection. This feature is their hierarchical nature, which evokes ''prioritization'' (Pratt & Foreman, 2000, p. 33) to retain the core identity's dominance formed in the early stages of the occupation's emergence.

These processes resonate with the types of relationships among multiple identities identified by Ramarajan (2014): complementarity and tension. Hierarchical aggregation subsumes a relationship of complementarity among identities, as depicted in the upper path of Figure 2 in the dashed line separating the identities. By contrast, hierarchical segregation subsumes a relationship of ''tension and conflict'' (Ramarajan 2014, p. 613). As with aggregation, both identities are retained, but there is not perceived strong synergy between them and they are kept segregated, as depicted in the solid line separating the identities in Figure 2. Although the ways in which occupational identities are hierarchically aggregating or segregating may vary across occupations, for aggregated layering to occur the forces connecting the identities must be stronger than the ones separating them; for segregated layering, the forces for separation are as strong as (or stronger than) the forces for connection.

Our study found that specific socialization practices contributed to these forces (DiBenigno, 2022; Michel, 2012; Pratt et al., 2006; Van Maanen & Schein, 1979). In hierarchical aggregation, close-relationship socialization through apprenticeship allowed personal dyadic interactions in which experienced individuals directly guided newcomers through direct participation and meaningful work contexts. The apprenticeship model (DiBenigno, 2022) is highly beneficial, especially when the number of apprentices is still relatively limited (as were the astronauts at the time), making apprenticeship viable, and it was further enhanced by the perceived synergy between the core and the accreted identity. In contrast, the inclusion of the scientist identity was enabled by a different type of socialization, which took the form of an arm's-length relationship. Arm's-length socialization occurs through formal, standardized training programs that separate newcomers from experienced workers in structured educational settings (Van Maanen & Schein, 1979). In our case, expecting scientists to earn a pilot's license allowed the scientist identity to be included in the broader astronaut identity, but this type of socialization also subordinated the accreted identity. Although aggregation precedes segregation in our case, we find no theoretical reason that this must always be true. Moreover, occupations can hierarchically aggregate and segregate more than one identity. The gray arrow in Figure 2 labeled ''changing work demands'' pointing back to work–identity alignment depicts a cycle whereby new identities can be added over time.

Finally, and more generally, we not only view occupational identity formation in unsaturated spaces as involving the management of multiple identities; we also articulated the types of identities that may be involved in this process—proto, core, latent, and accreted identities—and we illuminated their role in occupational identity formation.

We have delineated some key differences between occupational identity formation in unsaturated versus saturated spaces, but there are key similarities as well. As referenced in our review of the literature, selection plays a critical role in both spaces. Especially as occupations are forming, there may not be time for extensive socialization to acquire new skills needed to meet evolving task demands; thus, groups of people, via selection, serve as important carriers of identity. Socialization (e.g., apprenticeship vs. arm's-length socialization) also plays a critical role, especially after the core identity is developed. Identity formation seems to involve a comparative process, even if the comparative referent differs between saturated and unsaturated spaces. Moreover, internal dynamics that involve multiple occupational identities may also play a key role in saturated spaces (see, for example, Bourmault & Anteby, 2023), even though so far these dynamics have been overshadowed by occupational jurisdiction battles. Future research is needed to justify these claims.

Limitations, Implications for Future Research, and Conclusion

Our qualitative analysis is based on a single case study from historical archival sources, which suggests limitations and boundary conditions that provide ideas for future research. In layering both through hierarchical aggregation and hierarchical segregation, the core identity is retained. However, our theorizing raises questions about whether that must always be the case. It is theoretically possible that the core identity itself may change, even though we suggest that for emerging occupations, changing a core identity might be incredibly disruptive, and thus the core is likely to be preserved. Extrapolating from extant research, we note that over time, resource constraints may force occupations to merge or fully integrate identities into the core, as maintaining multiple identities requires investments of people, time, and money (Pratt & Foreman, 2000). Our study also reveals the benefits of empirically capturing identity dynamics longitudinally. Future longitudinal research can examine how the proposed core identity layering model evolves over time, including whether core identities remain stable or transform through successive encounters with new identities and how this affects the boundaries of the occupation.

Another theoretical point we make is that saturated and unsaturated spaces differ, and mechanisms of identity formation in those spaces will reveal theoretically relevant differences as well. Establishing such differences rigorously requires comparative cases. Researchers could systematically compare identity formation mechanisms across saturated and unsaturated spaces. This could involve examining the same occupation emerging in different institutional contexts or comparing occupations experiencing varying degrees of competitive pressure.

Our layered accretion model is also one possible option for how identity forms in new occupations involving multiple identities. Researchers should continue to explore other patterns of complex formation for occupations involving the management of multiple identities. Future research can focus on other emerging occupations to examine how multiple identities interact over time. This focus includes investigating whether identity relationships follow predictable patterns (hierarchical layering, persistent tension, and competitive selection or integration) and which factors determine these outcomes. Based on extant studies and our own, one important factor may involve when multiple identities enter the occupation. In some occupations, there may be multiple

identities at the start, and pressures to form a core may result in merging or deleting some identities. In our case, multiple identities emerged over time, which resulted in a different pattern.

Finally, we emphasized the importance of mechanisms such as selection and socialization as influencing the layering process in a specific direction. Given the apparent importance of selection processes in determining initial identity composition, future research should examine how different selection criteria and entry pathways shape the management of multiple identities. For instance, it is theoretically possible that externally influenced selection could lead to the entry of an identity that is synergistic with the core, or that occupations may choose to aggregate, rather than segregate, a new identity that is not synergistic with their core. Layering patterns are likely to fall somewhere between the two paths we model in Figure 2. We suggest that layering patterns should be viewed along a continuum, as varying in their degrees of integration with the core identity (see the far right arrow in Figure 2). Future studies could also further distinguish between different types of socialization mechanisms (close-relationship mentoring versus formal training) and their differential effects on identity layering.

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ORCID iDs

Evelyn Micelotta https://orcid.org/0000-0002-7321-4881
Giulia Cappellaro https://orcid.org/0000-0003-3645-8462
Claudia Gabbioneta https://orcid.org/0000-0002-4242-4237
Michael G. Pratt https://orcid.org/0000-0002-2917-1781

Data Availability Statement

Our study adheres to the policy guidelines for qualitative research outlined in Administrative Science Quarterly's data and methods transparency policy. We use archival data sources that are publicly available. References to all those data sources are listed in the article and the Online Appendix.

Supplementary Material

Supplementary material for this article can be found in the Online Appendix at http://journals.sagepub.com/doi/suppl/10.1177/00018392261427746.

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Authors' Biographies

Evelyn Micelotta is associate professor and the Steven Grossman Endowed Chair in Family Business at the University of Vermont's Grossman School of Business. She received a Ph.D. in strategic management and organization from the Alberta School of Business (University of Alberta, Canada) and a Ph.D. in management engineering from Milan Polytechnic. Her research examines how organizations and occupational groups navigate complex institutional environments, focusing on responses to competing institutional logics, processes of institutional maintenance and change, and identity formation.

Giulia Cappellaro is associate professor of management in the Department of Social and Political Sciences at Bocconi University and a faculty affiliate of the Dondena Centre for Research on Social Dynamics and Public Policy. She holds a Ph.D. in management studies from the University of Cambridge. Her research integrates organization studies with public policy to examine how organizations and occupations respond to large-scale societal transformations, including technological change, population aging, and disruptions in knowledge practices. Her current work focuses on decision-making under ambiguity and uncertainty, the adoption and enactment of algorithmic systems, and the implications of these processes for work, identities, and occupational relations.

Claudia Gabbioneta is Chair in Accounting and Management at the School for Business and Society at the University of York. Her research focuses on occupations and professions, as well as on organizational wrongdoing. She received a Ph.D. in management from IULM University.

Michael G. Pratt is the O'Connor Chair in the Carroll School of Management at Boston College and an Academy of Management Fellow. He earned his Ph.D. in organizational psychology from the University of Michigan. His problem-centered research explores cross-level dynamics within organizations, focusing primarily on how individuals connect with their work, as well as with their groups, organizations, occupations, and other collectives. He mainly explores these problems in the field using qualitative methods. His recent work explores issues of identity polarization, moralization, occupational identity formation, and trust/trust repair.