# Chapter 4
# Rethinking the Role of Productive Interactions in Explaining SSH Research Societal Impacts: Towards a Conceptual Framework for Productive Science System Dynamics


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**Abstract** In this paper we seek to realise the potential that Spaapen and van Drooge's productive interactions concept offers, but which we argue has been lost through its operationalisation as a process of 'counting interactions'. Productive interactions arise through moments of contact between two very different systems (the societal and the scientific), and each system values societal impact in very different ways. Finding mutual value in that interaction is important, and we argue that value in both arises when network arrangements shift, as academic disciplines solve urgent scientific problems and as societies improve living conditions. Productive interactions approach assumes the value-frameworks of the wider networks within which particular knowledge sets become actionable. However, our constructive critique highlights the omission of the wider elements of science and social systems within which productive interactions takes place (and whose dynamics ultimately determine the final scientific and societal impact of that research). Indeed,

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research evaluation to date has not considered the consequences of the productive interactions in terms of these changing relationships. To contribute to this lacuna, we propose a model that conceptualises a meso-level system comprising interactions between actors within two subsystems, highlighting the importance of coupling between researchers and users, valuation signals given to particular productive interactions from researcher and societal communities and the way these signals in turn embed useful knowledge practices. We apply it to a set of examples of productive interactions in the field of social sciences and humanities (SSH) gathered in the framework of a European project.

**Keywords** Research evaluation · Research impact · Social sciences and humanities · Science policy · Science studies

## 4.1 Introduction

A dominant concern for contemporary science, technology and innovation policy-makers is driving public research investments to create socio-economic impact. Recognising knowledge capital's contributions to productivity growth drove decades of public investments in science & research (Temple, 1999). But the policy belief persists that upstream public research investments only weakly drive technology development and innovation: the research 'impact' notion has emerged, making a science mission of driving socio-economic innovations. Scientists are increasingly *evaluated* on how far their research drives societal changes, the UK Research Excellence Framework being exemplary (Sivertsen, 2017). Across Europe research impact is also increasingly important in research evaluation.

However, in rushing to evaluate the research impact, policy development has overtaken theoretical reflection (Donovan, 2007). Patents, license income and spin-offs remaining a dominant frame for science studies' analysis of impact creation (Perkmann et al., 2013), but are useless for evaluation practice (Crossick, 2009). European research councils funded many impact creation studies, but these were primarily technical, avoiding understanding how evaluation systems influence on impact creation (Watermeyer & Chubb, 2018). The European project SIAMPI proposed the concept of 'productive interactions' (Molas-Gallart & Tang, 2011; Spaapen & van Drooge, 2011), as interactions between two actors in different systems, researchers and users.

Their systems have different values, norms and practices: productive interactions require aligning these different systems. Whilst an *interaction* offers an 'evaluation object', aligning these systems is a more significant impact element. Productive interactions may represent a single event, or drive a systemic change. These systemic changes are more desirable for policy-makers, and in this chapter, we conceptualise these wider systemic dynamics by asking the following research question: how do the elements of scientific and societal production systems become better aligned through productive interactions?

We develop a conceptual framework contextualising productive interactions within their wider systems, highlighting three additional elements shaping productive interactions: coupling, parallel progress and structuration. We use this framework to extend case study set of productive interactions derived from the Spanish National Research Council (CSIC) in the social sciences and humanities (SSH). We identify that coupling is driven by mobility, motivation and circumstance, that parallel progress requires valuation signals, and structuration is legitimated by parallel value signals out of the respective spheres. We conclude the productive interaction concept is useful for research impact evaluation, but it requires further theoretical development to become an academic concept.

## 4.2 Developing a Conceptual Theory for Evaluating SSH Research Impact

The productive interaction concept did not drive a wider conceptual breakthrough of how research impact is articulated or evaluated, and became dulled into a process of 'counting interactions'. The productive interactions concept avoids dealing with how academic knowledge becomes actionable, creating social value by promoting societal development. Productive interactions arise through moments of contact between two different spheres (societal and scientific), where each sphere values those impact-creating activities very differently. Effective productive interactions involve finding 'mutual value' for actors in both systems: academic value arises from research solving scientific problems, societal value arises from improving 'negative living conditions'.

### *4.2.1 The Emergence of the Productive Interaction Concept*

Impact creation became an explicit research evaluation object in leading countries after 2005 (Benneworth et al., 2016; Petersohn & Heinze, 2017). From 2002, UK research council grant applications should include an impact statement; from 2014, *ex post* impact creation became (via the REF) specifically tied to resource allocation (Bulaitis, 2017). The first Dutch Standard Evaluation protocol in 2000 stated impact as a policy goal, the second in 2005 provided guidelines on evaluating it, and since 2010 impact has been a substantive consideration in research evaluation. (Benneworth et al., 2016; Van der Meulen & Rip, 2000). But these evaluation processes remained ambiguous regarding precisely what need be assessed, and against which criteria (Molas-Gallart, 2015). A few commercial indicators suggesting research could drive economic growth popularised impact with policymakers, but were too limited to measure impact, even if the UK's Higher Education Innovation Fund used them to allocate funds (Benneworth & Jongbloed, 2013).

Scientometrics defines a publication's 'scientific impact' as uptake by other researchers (Petersohn & Heinze, 2017). Citations help measure scientific impact–citing an author shows dependence on their contribution. Imperfect and prone to behavioural distortions (Hall & Martin, 2019), scientometrics is sufficiently conceptualised to allow citations to represent to both policy-makers and scientists a reasonably legitimate *proxy* of scientific impact (even if decision-makers refuse to use bibliometric data responsibly, Hicks et al., 2015; Wilsdon, 2016). Societal impact measures never achieved comparable legitimacy, creating an urgent policy pressure to define social impact that (a) can be operationalised and measured, and (b) is legitimate to academics and policy-makers.

Several work-arounds filled these gaps: the UK adopted a peer-review methodology using departmental impact case studies assessed qualitatively and scored subjectively against three criteria (scale, scope and value) (HEFCE, 2011; Martin, 2011; Sivertsen, 2017). Bibliometrics companies developed proprietary societal impact measures (e.g. Altmetrics, PLUM (qv)) which largely lacked legitimacy (Andrews, 2018; Haustein et al., 2015). There have been surveys measuring behavioural and attitudinal aspects of scientists' orientation in the UK and Spain (Hughes et al., 2011; Llopis et al., 2018; Olmos-Peñuela & Castro-Martinez, 2014). But these failed to build legitimacy as a new impact measurement frame amongst both policy-makers and scholars (Wróblewska, 2017). Science policy-makers responded by funding research into research impact measurement. The Dutch-funded Evaluating Research in Context (ERIC), and the later European funded project 'SIAMPI' (Benneworth et al., 2016; Molas-Gallart & Tang, 2011) created the **productive interactions** concept as a first research impact definition (van Drooge, *pers. Comm.*).

### *4.2.2 Productive Interactions as One Element of a Productive Science System*

Spaapen and van Drooge (2011) define productive interactions as:

> Exchanges between researchers and stakeholders in which knowledge is produced and valued that is both scientifically robust and socially relevant. These exchanges are mediated through various 'tracks', for instance, a research publication, an exhibition, a design, people or financial support. The interaction is productive when it leads to efforts by stakeholders to somehow use or apply research results or practical information or experiences. Social impacts of knowledge are behavioural changes that happen because of this knowledge (Spaapen & van Drooge, 2011, p. 212).

The productive interactions concept has a materiality, the 'transaction', linked to an underlying scientific process, avoiding two common traps in evaluating societal impact, assuming scientific research was intrinsically productive, or demanding extraordinary outcomes (Sivertsen & Meijer, 2020). Their definition provided both academics and policy-makers with a legitimacy claim: academics appreciated its relation to everyday research activities, and policy-makers valued its capacity to

include user demand. There are three kinds of productive interactions, direct (personal) interactions, indirect interactions (mediated through artefacts) and financial interactions (economic transactions). Productive interactions *imply* more substantive change as transactions between partners are embedded within different contexts, and those transactions could impact upon those contexts. Spaapen and van Drooge (2011) acknowledged their concept does not address those wider systemic changes although those wider changes are non-trivial. This downplays two important elements of productive interactions, namely how impact generation becomes integrated within everyday scientific practices, and how using scientific knowledge changes societal behaviour.

Productive interactions take place within (well-ordered) science systems involving regular interactions between scientific and social decision-makers (Kitcher, 2001; Sarewitz, 2016). Societal interests may influence on scientific practices, with mechanisms by which scientific researchers become aware of societal partners' interests and needs (Gläser, 2019; Kitcher, 2001; Laudan, 1978). Societal partners may influence scientific decisions by contributing to shared knowledge activities that produce knowledge from which they may later benefit (Olmos-Peñuela et al., 2015; Azagra-Caro et al., 2020). A productive interaction is a moment of coupling in these well-ordered science systems, where scientific actors encounter societal actors and in which new kinds of scientific and societal value may emerge (Benneworth & Olmos-Peñuela, 2018; Gläser, 2019). New scientific value may emerge through inspiration and problem-setting, shaping what kinds of questions are deemed 'good' research leading to new scientific domains (Olmos-Peñuela et al., 2015). Social value emerges when a knowledge asset drives socio/economic development (Corea's, 2007), which may be economic, such as technology spin-offs, or socio-political, where academic knowledge contributes to democratic renewal or challenges deeply-held societal beliefs (Benneworth et al., 2016; Bozeman et al., 2015). This system change effects are present in productive interactions as a concept, but are largely absent in its practical utilisation, something which undermines its validity.

## 4.3 Distinguishing the Conceptual Elements of Productive Science Systems

Productive interactions involve knowledge activities spanning scientific and societal spheres. Science typically seeks to produce open general-universalist knowledge, maximising uptake. Societal users value locally-specific knowledge with direct private benefits. These differences can potentially undermine productive interactions, when actors cannot find ways to both benefit from interactions. Any successful productive interaction has managed to fit these dynamics and benefits of societal and scientific partners together, which we conceptualise as three characteristics:

1. Coupling – actors work together around a shared purpose, interacting and sharing the knowledge through collective working;

2. Progress – the work undertaken by the two actors becomes visible and has impacts on other actors in their respective societal and scientific systems;
3. Structuration – there are changes in the overall systems topologies within which the two actors are active.

First is coupling, the mutual exchange process which benefits each participant by providing access to resources valued by each partner. Societal partners benefit from a capitalisation effect: knowledge can later be mobilised as capital within their own social systems. Through proximity to the societal partner, a scientific partner can quickly respond to their input, providing an "early warning system" for emerging topics. In some productive interactions, mutual benefit may not be directly visible to either participant; but following Kitcher (2001), we argue a societal user using a piece of scientific knowledge sends a signal to the scientist that may shape the scientist's future inspiration, planning and framing activities. In financial interactions, the mutual benefit is obvious, the societal partner provides resources to the scientific partner, which may support further research. But financial interactions are not always significant, particularly in social sciences and humanities (Olmos-Peñuela, Molas-Gallart, & Castro-Martínez, 2014), and tightly focusing on finance hinders a wider understanding.

Second is progress, parallel progression within distinct connected systems: (a) scientists seeking to create new knowledge by addressing urgent research questions, and (b) societal users seeking to drive societal development. Moments of 'coupling' allow the creation of a shared common knowledge resource, but the mutual activities become a temporary common direction of travel changing both subsystems ('progress'). Academic progress comes through new knowledge being created, and potentially new domains, fields and practices of research (Neff, 2014). Societal progress comes through societal partners using that knowledge to create things they value.

Third is structuration, changes within scientific and societal systems resulting from that 'progress', actors achieving outcomes that are positive in their own. That may in turn affect those actors' contexts, creating connections and resources with a more regular effect, representing new systemic capacities. Scientists may develop newly accepted ways of working that facilitates: (a) additional future productive interactions with societal partners, and/ or (b) creating assets, infrastructures and knowledge cognate with social partners which ensure that social partner knowledge is better used in future research (a simple example here being living laboratories). Societal partners experience structuration as one-off networks becoming more generalised, potentially creating new classes of professionals, new curricula or new kinds of legislation and regulation. Although the interaction does not *cause* these systemic shifts, productive interactions make them possible.

## 4.4 Methodology

These three elements provide our conceptual framework, which we use to characterise a set of narrative examples of societal impact in terms of four conceptual elements: productive interactions, coupling, progress and structuration. The cases, drawn from Spain from the SIAMPI project, examine how these three additional elements of dynamic science systems – coupling, progress and structuration – function in practice. Although repurposing antecedent information for our own needs, there is sufficient correspondence between the questionnaire structure and our model of productive science systems to make the dataset fit for this purpose within an unashamedly exploratory piece of work. The underlying Spanish dataset contained twelve interviews with SSH research groups: interviews were undertaken with these research groups, as well as with users of the knowledge created by these groups. We selected five examples with a clear productive interaction. Where there was insufficient data to provide a reasonable stylised representation of the three elements, we approached the research group for clarification. An initial first analysis revealed the presence of the four dimensions whilst providing a degree of diversity, and a degree of depth in the empirical material to avoid presenting excessively synthetic findings.

## 4.5 Introduction to the Case Studies

### *4.5.1 Music: Recovering Unpublished Spanish Musical Works*

The first research group is an early music research group, recovering unpublished Spanish poetic-musical works from the 16th/ 17th centuries, translating them into modern notation and contextualising them using literature studies to support contemporary performance of disappeared Spanish culture (Castro-Martínez et al., 2013). One leading research partner was the director of a vocal and instrumental early music ensemble, also executive of a small record company specializing in early music, who met the group while doing his doctorate. Madrid's regional government wanted to commemorate the 400th anniversary of Don Quixote's publication, so commissioned him to very quickly publish an album. Hitting the anniversary deadline was only possible because the group had in-depth knowledge of the Don Quixote text and contemporary musical works that could be adapted to each selected text. The company subsequently developed a commercial line of previously-unpublished Spanish poetic music revitalised using research results, interacting with the CSIC research group though the stages of musicological research. This involves (a) finding and identifying largely unpublished musical works in national and international libraries or cathedral archives, (b) transcribing to modern notation (for current musicians), their study/ musical analysis, comparison with other

versions (where applicable), and definitively fixing score and poetic texts (c) historical, aesthetic and cultural contextualization to support transcription and scientific rigor, then (d) making these recovered compositions available to other researchers (musicologists) or current practical musicians.

Interactions between the ensemble conductor and the CSIC research group occurs at all stages: exchanging documents, discussing interpretations and analyses. These interactions also occur during the CD production process, in selecting the composer analysed, the works included in the CD (selecting the most appropriate/ original), writing the *libretto* and selecting images. All editions are produced very carefully, its market being strongly dependent on commemorations and anniversaries. Although the company's commercial interests influenced the research group's choices, all the 'rediscovered' works contributed to creating new knowledge about Spanish poetic-music work.

Commercial 'influence' on the research group included sharing information on opportunities, proposing potential new works, and together agreeing on collaboration areas with potential scientific and societal impact. The research group sought to enrich its transcripts to be useful to the interpreters. The ensemble director, whose market niche was specifically in recording of newly recovered and never-performed Spanish works, used the interaction to affect how he directed and interpreted the works. The richness of documents analysed by the research group indicated suitable instruments to be played, ways of playing and the creation context, thereby helping with a richer, historically faithful interpretation.

### *4.5.2 Theatre: Placing Spanish Baroque Theatre in a Wider Context*

The second research group analysed Spanish baroque theatre; in contrast to more traditional approaches to theatre studies (philological text interpretation), the research group focused on analysing the whole performance in an integral way (from staging, interpretation, production, through scene, direction, to the performance's reception critics and audiences). This broader approach produced different results, providing directors and actors additional elements (beyond the texts) for representing the works more reliably in terms of staging and interpretation. These broad approaches partly derived from the research group leader's previous experience as director of the Almagro International Classical Theatre Festival, where he realised the value of approaching theatre as text and interpretation. This approach lent itself to supporting theatre companies, drama festivals and drama schools seeking to perform those pieces more accurately, most notably the Director of Spain's National Classical Theatre Company (NCTC).

The collaboration began in 2004 with the appointment of a new NCTC director inspired by these scientific approaches and interested in performing theatrical works of the Spanish Baroque. He was specifically interested in expanding the NCTC's

repertoire with works retrieved and interpreted in accordance with these new approaches. They collaborated for several years, finding and analysing documents about how works were performed, and contrasting different versions of the works. The NCTC was interested in historical and literary analyses of the works/ authors of the Spanish Baroque, in the relations between works and their authors, and in representing the work in a coliseum (or current theatre). One important finding was recognising that classical Spanish theatre representations were strongly influenced until the 1960s by French 18th fashions, rather different to Spanish fashions.

Research results were published in an NCTC collection, providing an interpretation more faithful to the prevailing fashions at the time of writing and first performance. The NCTC collection was aimed at disseminating these new approaches via actors and directors, as well as the general public and secondary school teachers. Results were also disseminated in scientific activities and conferences, where actors and directors participated influencing representations of Spanish theatrical works, not only in the NCTC, but more generally across Spanish theatre.

### *4.5.3 Philosophy: Using Insights on Barbarism to Improve Road Safety*

The third case came from a philosophy research group analysing barbarism, particularly promoting public reflections about violence victims defined from terrorism and genocide to road accidents, using practical examples to promote critical thinking in society. The group was a European pioneer in approaching these problems from the centrality of the victims. The research group was known to the Road Safety Prosecutor, who asked the group leader to address a conference of public prosecutors regarding Spain's high automotive mortality (c. 6000 deaths in 1989, falling 1100 in 2014, partly resulting from the policy developed). The researchers focused on drivers' awareness of driving within modern society: speed is regarded as positive, speed's benefits are more immediately visible, whilst its attendant costs and risks are invisible to speed's beneficiaries.

In 2007, the Prosecutor asked the group to identify human rather than technological causes of societal insensitivity to traffic accidents from their humanities perspective (philosophical, cultural, anthropological and psychological). The group ran a research project funded by the Ministry of Science, involving seminars, inviting different stakeholder representatives to jointly discuss the issue, guiding discussions to achieve the expected practical results (such as proposals or recommendations). The group already had experience on other social issues, such as terrorism, where they deployed a similar strategy. The Prosecutor came whenever possible to the activities, and was apprised of the group's results.

The group used all available means to disseminate the results. Stakeholders supported this by conducting their own dissemination in their own outlets such as

the press, training, victims' associations' websites and conferences. The project website disseminated materials generated, operated discussion forums (including for consultations), and linked to stakeholders' web pages. They organised seminars and symposia with stakeholders to discuss this topic, involving journalists, researchers from other interested areas, the road victims' association, the Royal Automobile Club and the Prosecutor's office. Many results were incorporated by the Prosecutor's report to Spain's Congress of Deputies (2015) to support improving legislators' insights into road traffic fatalities and new legislative proposals for road education, accident prevention and punitive responses.

### 4.5.4 *Archaeology: A Research Group Valorising Historical Excavations*

The fourth group was an archaeology group studying cultural heritage, how societies ascribe significance and value to heritage assets, and its change over time. The 1985 Spanish Heritage Act provided a first framework for managing and protecting cultural heritage, requiring *ex ante* archaeological and environmental impact assessments for public works, creating a new business sector, 'archaeological services' (Parga-Dans et al., 2012). Regional governments developed their own archaeological laws for territorial heritage presentation leaving no standardized reporting formats or procedures.

The Act stimulated several companies to establish formal agreements with the group, and the research group's agenda evolved from primarily archaeology into heritage in a wider sense. The archaeology service clients had a substantial interest on the group's research choices, methodologies, new technologies, reporting approaches and frameworks. Public agencies developed informal connections to the group as experts to receive advice on how to best implement protocols and interact with community groups to understand anthropologically how local communities respond to excavations. The group's scientific outputs were ultimately shaped by a range of influences, purposive and non-purposive, reflecting both scientific and societal choices.

### 4.5.5 *Heritage, Memory and Conflict: Regeneration & Franco's Legacy*

The fifth research group was working on heritage, memory and conflict, understanding social processes of communities or societies managing 'uncomfortable or painful' heritage assets for the present and future. One project studied the Carabanchel prison (near Madrid), imbued with a shared sadness from the Franco regime, where many political prisoners were imprisoned, carrying emotional and emotive

significance for neighbours and other groupings (political prisoners, associations of historical memory). The prison was abandoned in 1998: both neighbours and 'La Comuna' (The Commune association of former political prisoners) attempted to reinvent its place-identity as exemplifying repair within Spain's transition to democracy. Government plans to demolish the jail inspired the project, the group making a full documentary record of the prison exploring how local residents came to accept the uncomfortable asset heritage; the demolition produced a desire to transform the jail site into a cultural centre to the memory of repression. The researchers produced a historical record (storing and archiving memorials, as well as photos and audio recordings around the memorials) of those monuments as a first step in analysing those mourning practices (Ortiz-García & González-Ruibal, 2015). The local community valued the group's work to harness the negative emotions of living in a 'tainted' community towards accepting and reusing the building. The project produced a photo exhibition of former inmates, alongside a DVD charting the estate's expansion in Francoist political context. Despite the group's proposals and the community desires, the prison was completely demolished in 2008; although being split across two jurisdictions at the time of writing it remains derelict.

## 4.6 Coupling, Progress and Structuration around Productive Interactions

To answer our research question regarding how the elements of scientific and societal production systems become better aligned through productive interactions, we structure these five case studies around the three systemic elements surrounding individual productive interactions (see Table 4.1).

### *4.6.1 Coupling, Progress and Structuration Around Musicology Productive Interactions*

In musicology, there were two separate development trajectories, excellent scientific knowledge on lost manuscripts, and a company producing new recordings of rediscovered pieces. The productive interaction was embedded in coupling interests already operating for a relatively long period. The company executive already knew of the research group from the time of his own Ph.D., and knew the group and their expertise prior to contacting them. The group's ability to react to the business case (anniversaries and deadlines) also facilitated the productive interaction, creating activities that contributed to public awareness of Spanish baroque inside and outside Spain, and value for that interpretative approach/ new research objects, validating the researchers' quality. An extended community of artists who had participated in La Grande Chapelle Ensemble taking this approach left many Spanish and European

**Table 4.1** Coupling, progress and structuration of the five selected case studies

| | Coupling | Progress | Structuration |
|---|---|---|---|
| Music | User had prior knowledge of research group from own experience as Ph.D. researcher.<br>Ability of research group to react to timescales of commercial partner. | Producing new research lines (a new book on the rediscovered music) and commercially valuable products (published music). | Construction of a new interpretation approach, 'anniversary rediscovered music'.<br>Legitimation of 'music rediscovery' as a field of academic study suitable for SSH research funding and publication. |
| Theatre | Achieved by an outplacement of professor as cultural festival director inspired to make own work more influential on cultural products.<br>User as a laboratory for professor to experiment on dramatology. | New research line for professor inspired in a sociological approach of Spanish vernacular baroque theatre, not only texts studying.<br>Creation of new cultural products: vernacular Spanish baroque theatre and books to widely disseminate the approach developed. | Embedding of new ways of working in the system: the co-creation of the research subject through cultural production that then forms the basis for both cultural consumption and academic hermeneutic research. |
| Philosophy | The group research approach was already appreciated by the public prosecutor because of a previous piece of work.<br>Professor valued the invitation because the proposed topic (road safety) fit with the main line of the group (the centrality of victims). | A new research project including some activities with social actors were produced (seminars and symposia) on the barbarism and drivers theme.<br>The prosecutor was able to influence legislators to address a key public safety issue (RTA fatalities). | Legitimation of this more contemporary research approach in philosophy of which the group was a pioneer in Europe.<br>Acceptance of the value of academic knowledge by legislators in addressing RTA problems. |
| Archaeology | Coupling driven by mutual interest between users and academics as they sought to make sense of how to operationalise new law. | Creation of a new archaeology service sector with (some) links back to academic archaeology to establish archaeological impact statement processes.<br>Academics shifted to studying 'archaeology practice' and regulations' effects on businesses. | Construction of coherent field of users and academics with many mutual interactions as part of routine 'way of doing business' driving both practice and research. |
| Heritage, memory and conflict | Willingness of researchers to adopt 'campaigning' role for Carabanchel residents and prisoner associations.<br>Fit of 'natural' curiosity | Construction of symbolic academic value (published books, a PhD thesis).<br>Memorialising of a tainted site, recording | Memorialisation of the site as demonstration of value of academic involvement in citizen activities. Relations between the group and |

(continued)

**Table 4.1** (continued)

| | Coupling | Progress | Structuration |
|---|---|---|---|
| | with residents' desire to memorialise a tainted location. | prisoners' histories and producing cultural artefacts (videos). | the prisoners' association once the project has been completed. Further validation of academic legitimacy of overall field. |

Source: authors' own design

artists knew and valued the approach, and were keen to participate in new productions, feeling participation helped drive their artistic growth. The research group, disseminating its work openly, saw transcriptions being downloaded extensively both in Spain and abroad, and its approach being valued in international musicological media.

### *4.6.2 Coupling, Progress and Structuration Around the Theatre Productive Interactions*

The second example addressed a productive interaction between a theatre company and a theatre studies research group reimagining Spanish baroque theatre without vestiges of French courtly practices. These two systems' coupling was achieved by a CSIC professor's successful residency as a cultural festival curator. This residency firstly influenced *academic* progress inspiring the professor to new research lines tailored to excavating baroque theatre, in turn the basis for successful new forms of renewing cultural practice via NCTC (*societal* progress). Structuration involved two fields, building a sense of legitimacy of the co-created cultural activities in each system, rediscovered theatre as a legitimate object of research, but a new approach as a form of patrimonic culture. This had a wider symbolic value to NCTC alongside other theatre professionals who adopted this more authentic approach in their own productions. The group continued to direct its research towards "dramatology".

### *4.6.3 Coupling, Progress and Structuration Around the Philosophy Productive Interactions*

Thirdly, the application of the philosophy research group's approach (centrality of victims in processes of social suffering) to the road safety case arose at the request of the Attorney General (AG) for Road Safety. The AG was aware of the group's work and considered their approach relevant for attempts to reduce the number of traffic victims. Coupling followed a brief correspondence where professor and Prosecutor

realised that productive interactions were possible in this case. At the prosecutor's request, the group developed a multi-disciplinary research project, financed under the national R&D plan, where bringing together specialists from various disciplines (philosophy, anthropology, law, sociology) alongside open seminars for various social actors (victims' associations, automobile clubs, journalists). The interaction represented scientific progress because it drove research activities (seminars and symposia), opening up a new research beyond the philosophy of history into public policy areas. It represented societal progress helping the prosecutor to inform legislators to encourage death reduction actions. There were not obviously observable structural changes in either societal and scientific systems, although this applied interdisciplinary philosophy practice has wider consequences for the social value of philosophy in Spain, helping legitimate philosophy's value more generally at a time when the humanities were under pressure by being considered as luxury disciplines.

### *4.6.4 Coupling, Progress and Structuration Around the Archaeology Productive Interactions*

The fourth case involved regular productive interactions between an archaeology research institute and archaeology services, a sector that emerged in response to a law creating new definitions of heritage and a mandate for action around architectural preservation. This societal progress, creating this new service field, stimulated the academic progress, namely new archaeology research domains. Productive interactions came through many exchanges as these two sides tried to navigate these legal provisions. This well-structured community drove continued interactions, and continued validation of these two fields as being socio-economically and academically legitimate respectively. In response to the financial crisis reducing public construction projects, both firms and the research group reoriented part of their activity towards other stages of the patrimonial processes (Parga-Dans et al., 2017).

### *4.6.5 Progress, Coupling and Structuration in the Heritage Productive Interactions*

The fifth case involved were interactions between researchers in heritage, memory and conflict and local residents, to explore the memorialisation and preservation of an infamous Franco-era prison complex scheduled for demolition. The research group already had a strong public profile because of their successful previous project exploring the memorialisation of the 2004 Madrid train bombings. Earmarking Carabanchel for closure piqued their curiosity and drew engagement with local residents around closure. Academic resources and the documentary making

stimulated local cohesion, adopting the academic idea as a cultural production activity expanding to the memorialisation of prisoners. Coupling was produced by the research group's engagement expertise finding a connection into a symbolically significant development, co-constructing a cultural production activity that also drove academic production, including a scholarly volume. The multidisciplinary team were exposed to a range of social engagement practices, historians to community engagement, anthropologists to politicians, film directors, photographers, legitimating those engaged approaches as 'scientific'. The societal actors progressed by incorporating 'scientific criteria', vocabulary and concepts about their experiences and thereafter, their public activities were expressed deploying that vocabulary.

The structuration produced a memorialisation of the role of Carabanchel in Franco-era repressions. The relationship with the group profoundly impacted the social actors: the neighbourhood association sought contact with other similar places, the association of ex-prisoners formed as a direct consequence of the project. Other civic groups were created: a photographer (Jesús Rodríguez, now retired) collaborated with the neighbours and others; Sergio García, an anthropologist, organised guided tours for the neighbourhood, influencing its urban development. This experience gave rise to a doctoral thesis, published as a book (Martínez-Zauner, 2019), launched in association with 'La Comuna'. These scientific results demonstrated that highly engaged co-creative research can be academically legitimate, changing academic practices.

## 4.7 Dynamics of Progress, Coupling and Structuration in SSH Dynamics

These five cases allow a stylisation of the operation of our model in practice. In Table 4.1 below, we summarise the five cases distinguishing characteristics of these three elements. Coupling involves micro-scale resolution of user-researcher interest conflicts around the mutual activity. Progress involves creating novel artefacts and activities which are valued by other actors in the respective communities. Structuration involves wider expressions of value, with those activities to achieve a more permanent and enduring impact in societal and scientific practice. More detail is provided below.

*Coupling* involves resolving researcher and user interests to allow productive interactions. We identify three coupling mechanisms, namely mobility, predilection and circumstance. Mobility involves individual actors moving between the spheres, whether a Ph.D. student later becoming a commercial publisher, or an academic playing a role in societal or cultural production, like a festival director. Predilection involves an actor wanting to play a role in another sphere, evident where researchers developed their own roles as public intellectuals or activist researchers. Third was when circumstance effectively created or facilitated this coupled community, most

evidently when contract archaeology was created as a highly regulated field, or the urgency to document a controversial prison scheduled for demolition.

The second element was *progress,* involving novel activities and artefacts in which others then expressed legitimacy and value. These activities and artefacts were observable in research when new fields were created: knowledge created in productive interactions unlocked further academic progress. The dependence of societal artefacts from productive interactions involves those artefacts' value depending at least partly on qualities brought by academic knowledge. In two cases, a new kind of cultural interpretative approach was created (rediscovered classical music and vernacular baroque theatre) embodying cultural capital depending on authenticity derived from academic knowledge.

The third element was *structuration*, where validation mechanisms expressed through progress change the overall systems facilitating (or potentially inhibiting) future productive interactions. Scientific progress builds upon user knowledge in creating new research pathways and lines, and validates the use of societal knowledge in research, creating alternative research pathways. There is the production of new kinds of norms, for example: (a) the use of cultural production as 'laboratory' for humanities knowledge creation as in the vernacular theatre case, and (b) user practice and knowledge circulating in academic research practices, as with seminars and symposia on barbaric road users. Societal structuration involves creating artefacts with a persistent effect. This may be a landmark effect, seen most evidently in Carabanchel, where a memorial record was created of place-specific human rights abuses. These may be unselfconscious practices that diffuse into user communities, such as the behaviour of public prosecutors or archaeological consultants, whose ongoing practices were shaped by regulations in turn shaped and interpreted involving academics. It may finally be at the wider societal level creating a new strand in societal debate, relating to cultural patrimony and national identity, visible in some degree in the theatre, music and heritage and memory cases.

Structuration involves validation mechanisms where that value makes the productive interaction seem useful. One element arises though the validation of that academic research including societal interests as being rigorous, in turn validating the academic norms that produced that knowledge by incorporating societal knowledge. The aggregate effect at system level permits research practice to incorporate user knowledge to perceive phenomena that would otherwise remain invisible. The societal structuration involves creating something persistent, with an underlying societal interest, whether a new kind of interpretative approach within a cultural product or a landmark like a memorial.

## 4.8 Discussion and Conclusion

The five cases provide a means to observe that productive interactions are embedded within wider changes within science and societal systems. This adds a depth to the productive interactions concept, highlighting wider changes in the scientific and

societal systems, related to the observable productive interactions. These wider changes represent a form of impact, and by studying this value-creation process, associating it with the production of scientific knowledge, we can better understand what matters about productive interactions and, therefore, what precisely policy-makers should seek to encourage if they wish to optimise scientific valorisation. With the caveat that this was a relatively small exploratory study, our findings therefore can contribute to academic and policy development.

We find productive interactions are embedded within wider value production processes and productive interactions happen where there is the potential for a productive interaction between the scientific and societal spheres (*cf.* Muhonen et al., 2020). We can better specify this 'potential for constructive interaction' as something that can actively be built and influenced. Because scientific production is forward-looking, with scientists planning activities in terms of their expectations of the reception their work will receive academically, the potential also reflects the expectations on how work incorporating societal knowledge will be received. One element is something giving the two spheres insights into each other's mindsets, whether mobility, predilection or circumstance. The second element is where shared production is valued in both respective spheres. The third element is these value signals legitimate these activities and artefacts and lead to their wider (unselfconscious) diffusion in science and society.

Therefore, we argue that the productive interaction concept has value in understanding (as well as for evaluating) how scientists create value in society. We also emphasise a need to better understand these value creation processes theoretically to produce understandings of research impact that better reflect the societal value that is created. Productive interactions are intrinsically beneficial, because they may be associated with distortion or substitution effects – they have been popular because they lead to something that is countable for evaluation purposes, but are ill-equipped to make higher level aggregate claims. By focusing on these parallel production processes and pointing to wider structural changes, a modified productive interaction concept can provide a useful lens for understanding how engaged scientists in productive science systems contribute to wider socio-economic development processes.

Our heuristic also has three implications for policy-makers. Productive interactions are a useful focus for research evaluation on societal impact because they capture something for which scientists are themselves responsible and are not themselves dependent on the quality of the absorption environment. Certainly, science policy should seek to encourage antecedent coupling activities as well as simply evaluating the resultant productive interactions, particularly stimulating and rewarding mobility and predilection (although this, itself, requires a better understanding of scientists' motivations for engagement). Our heuristic also highlights the importance of scientific valuation practices in establishing scientific development and, therefore, the need to ensure that scientific evaluation procedures are promoted in such a way that offers the opportunity to validate and signal value for engaged research practices. Finally, the systemic approach allows the understanding of the intensity and scope of productive interactions in terms of their coupling, progress

and structuration, and this may be very useful to identify, recognise and assess a field's scientific contribution.

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