Identifying Lesser-Known Actors of the 'Stuttgart School': An Event-Oriented Approach to Historical Network Research

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Abstract

The term 'Stuttgart School' has been used to describe local developments in the areas of concrete poetry, information aesthetics, and computational generative art and poetry. The article proposes to describe the larger Stuttgart School Network, on a local level, as being comprised of these intertwined areas. Following approaches in the history of knowledge that focus on collectives rather than single individuals, the Stuttgart School is modeled as a network of persons, institutions, publications, and events. Network data was extracted from a corpus of 23 texts consisting of material from the University of Stuttgart Archive's collection of press articles pertaining to Max Bense, along with additional historical and autobiographical accounts. An event-oriented approach was employed for the reconstruction of a local historical network through extraction, visualization, and contextualized interpretation. The outcome of the study regarding extracted network data should be seen as preliminary; however, together with the conceptual and methodological framework presented here, the extracted data can provide the basis for a more detailed and extensive reconstruction of the Stuttgart School Network.

1 Art and Science in Practice

The following article presents the results of exploratory historical network research on what has been called the 'Stuttgart School' – a constellation of persons, events, institutions, and scientific as well as artistic activities and discourse that emerged in three intertwined areas between the late 1950s and the early 70s: concrete poetry, information aesthetics, and computational generative art and literature. Research on the Stuttgart School often focuses on one or two of these fields and a small set of protagonists. The main goal of this exploratory empirical study is therefore to build a preliminary network of lesser-known actors of the Stuttgart School in order to identify potential clusters formed by persons, institutions, events, and key publications.

This case study is part of a larger effort to better understand the history of information aesthetics and computational generative art and literature. The focus on Stuttgart is based on the assumption that in this case, the local dynamics played an important role in the establishment of a network of protagonists and institutions where individual and, more importantly, collective development of scientific and artistic thought and practices could take place (Fleck, 1980). Such a history of knowledge is less interested in the singular achievements of prominent individuals as in the dynamics that lead to developments like the foundation of information aesthetics and the collectives that feed into these developments through their practices. Identifying lesser-known actors allows for a historical reconstruction of the Stuttgart School Network which takes into account the conditions for the generation of knowledge within a specific historical constellation of material practices, intellectual endeavors, and social activities.

The approach used in this study has partly been derived from Ludwik Fleck's concepts of thought collectives and thought styles, which emerge through specific productive practices in specific material environments (Fleck, 1980, pp. 54-55). In his studies on the nature of scientific research, Fleck argues that knowledge is not the result of individual genius or labor, but rather an effect of collective thought and practices, as in the case of a laboratory. These collectives and their interactions lead to what Fleck calls thought styles: a certain way of seeing, understanding, describing, and acting on things in an epistemological sense.

If we apply Fleck's ideas to the case at hand, the contributions of lesser-known actors must be considered crucial for the development of the thought collectives of the Stuttgart School and their concomitant thought styles. By describing certain actors as 'lesser-known,' it is acknowledged that most of these individuals and their work have been named in historical research and accounts, or in publications that circulated at the time. The goal of recon-

structing the Stuttgart School Network from this perspective is therefore not to find individuals that might have been forgotten, but to reconstruct the network as interconnected thought collectives or constellations. The notion of constellation applied here is derived from the historical modeling of philosophical knowledge production (Mulsow, 2005), where it is understood as a dense context comprising a well-defined set of persons and elements of discourse (ideas, theories, and material documents). Martin Mulsow differentiates between three levels of relationships: a micro level, where constellations are located; a meso level with larger organizational structures like journals or universities; and a macro level with an even larger scope. Constellations, he writes, rely heavily on oral communication and social interactions in formal and informal settings such as reading groups or university seminars, a criterion that applies perfectly to the Aesthetic Colloquium at the Technical University of Stuttgart led by Max Bense.

The Stuttgart School Network encompasses both the micro and the meso level, as it seeks to map dense connections of subgroups or clusters as well as the larger context or superstructures of these groups. Due to its focus on social connections, the data model developed in this study does not contain any elements of discursive enunciation like ideas or theories. The decision not to concentrate on a single constellation exclusively, like the group that evolved around Bense's Aesthetic Colloquium, is based on the notion that research on the Stuttgart School has often focused on a small set of protagonists, especially Max Bense himself, or on smaller groups belonging to one of the larger fields of concrete poetry, information aesthetics, or computational generative art and literature (Barbara Büscher, 2004).

2 The Stuttgart School

2.1 Conceptualizations in Historical and Autobiographical Accounts

The term 'Stuttgart School' has been applied to phenomena in the fields of concrete poetry, information aesthetics, and computational generative literature and art with a variety of meanings by scholars of cultural, literary, and art history.[1] According to Jörg-Rössler (2006), the term itself was coined by the author Manfred Esser at a conference of the French Tel Quel group in reference to the artists and researchers in Stuttgart connected to Max Bense at the time, and subsequently picked up in French and German news reports. Jörg-Rössler (2006) explicitly names concrete poetry, information aesthetics, and computational generative literature (not art) as the themes around which the Stuttgart School revolved.

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[1] There is also a Stuttgart School of architecture and a Stuttgart School of documentary film making, both of which have no direct connection to the present study (Köhler, 1996).

Reinhard Döhl, in a historical and autobiographical account of the Stuttgart School, proposes to distinguish between the Stuttgart School proper, by which he means the circle of researchers working on information aesthetics at the university, and the Stuttgart Group, which encompassed the broader group of authors and artists whose texts were published in the literary magazine *Augenblick* and the series *edition rot*, and whose work was exhibited in the University of Stuttgart's *Studiengalerie*, which was curated by Max Bense and Helmut Röttgen (Döhl, 1997). It is notable that Döhl was himself part of the history he describes, both in his capacity as a professor of literary studies at the University of Stuttgart and as an author of concrete poetry.

In her recent study on Max Bense's relationship to Brazil and Brazilian experimental poetry, Jasmin Wrobel describes a group of concrete poetry authors located in or near Stuttgart, namely Helmut Heißenbüttel, Reinhard Döhl, and Franz Mon, as the Stuttgart School, focusing on local protagonists of concrete poetry in her usage of the term (Wrobel, 2019, p. 293).

Meanwhile, in his in-depth study on the beginnings of computational generative art in Stuttgart, Christoph Klütsch uses the term 'Stuttgart School' to refer to a group of artists and scientists whose work on information aesthetics at the University of Stuttgart transcended the boundary between art and science (Klütsch, 2012). In the cases of Frieder Nake and Georg Nees, who experimented with computational methods and hardware to produce art, and Theo Lutz, who employed computational methods for poetic natural language generation, artistic production and scientific research were very much intertwined. The same is true for Max Bense, to whom all these individuals had strong ties. His interest in textual theory and text statistics found expression in an experimental radio play titled *TerryJo*. Here, Bense and his co-author Ludwig Harig, possibly supported by mathematician Siegfried Maser, a Ph.D. candidate at Bense's department, used statistical methods described by Claude Shannon to generate text with different levels of statistical order, thus recreating Shannon's approach in that they treated language as signal processing or communication in a cybernetic sense (Bense, 1998, 2000; Bense and Harig, 2000; Shannon, 2003). The use of analytical methods for the generation of works of art was conceptualized by Bense as generative art, with a strong focus on the mathematical and thus rational conditions of this specific kind of artistic production (Bense, 2004).

All these examples have one thing in common, namely that the term 'Stuttgart School' is used to describe a more or less specific group of persons that evolves around certain institutions and events, and that can be tied either to concrete poetry, information aesthetics, or computational generative art

and literature. Regarding the interconnection between these three different fields and the groups or constellations of actors, events, institutions, and practices involved, it can be observed that most research acknowledges the connection of at least two of these fields, with the early history of computational generative art being linked to research in information aesthetics, and the textual theory of information aesthetics to the formalist poetics of concrete poetry. This means that the data model for the Stuttgart School Network differs from the constellations that have been described as the Stuttgart School or Stuttgart Group in that it must be able to integrate the various constellations embedded in the broader Stuttgart School context. Topologically speaking, all constellations are part of the network, and should become visible as specific clusters. (Provided, of course, that the network is based on enough empirical data and that the clustering of the network actually reflects these constellations.)

When preliminary definitions of specific constellations or clusters in the Stuttgart School Network mature into concrete modeling decisions, broader methodological questions about heuristics and iterative adaptations arise, which go beyond the scope of this article. Methodologically speaking, the data model being used here was developed through heuristic abstractions from historical accounts. At the same time, the outcome of the modeled empirical data has itself informed adaptations of the model and can be expected to inform further historical research, as clusterings on the micro and meso level do not mirror heuristic assumptions, but rather introduce new connections and sometimes entirely different elements. This iterative development is part of an exploratory strategy: rather than providing a final picture, the network can be considered as an instrument for the identification of lesser-known actors and for further exploration of the histories of information aesthetics, computational generative art and literature, and concrete poetry.

2.2   Localization and Time Frame

Research on the Stuttgart School suggests that the network has a strong local component in that it appears to be tied to a specific and fairly limited geographic area. At the same time, protagonists of the Stuttgart School had a large number of interregional and international connections, regarding either scientific research and art: the *Studiengalerie*, organized and curated by Max Bense and Herwarth Röttgen, saw several exhibitions that featured the work of international artists (Thomas, 2019); the journal *Grundlagenstudien aus Kybernetik und Geisteswissenschaft* had editors located outside of Stuttgart; and the list of authors who published in the magazine *Augenblick* echoed the manifold relationships of the Stuttgart School beyond the

confines of the city and its immediate surroundings.[2]

By focusing on persons, institutions, and events located in Stuttgart, we hope to reconstruct the social ties that were rooted in regular and sustained cultural practices, particularly academic and art events. While most institutions, events, and protagonists of the Stuttgart School Network were based in Stuttgart, some of them moved on to other places, which, at the end of the period described here, was one of the reasons for the dissolution of the network. That being said, we recognize that formative events for the Stuttgart School Network, such as the "Morsbroicher Kunsttage" in 1961 and the "New Tendencies" exhibitions that took place in Zagreb between 1961 and 1973, occurred outside of Stuttgart and its immediate surroundings (Rosen, 2011). Important events such as these were transcribed to our extracted dataset if they were named in the corpus as an event according to our definition.

The early work on information aesthetics that was carried out at the University of Stuttgart (Bense, 1960), the experiment in generative literature conducted by Theo Lutz under the title *Stochastic Texts* Lutz (1959), and the works of concrete poetry by various authors based in and around the city (Gomringer, 2009), can all serve as indicators for the emergence of the Stuttgart School Network in the late 1950s. There is, however, no clear marker of its end – the Stuttgart School Network faded away as protagonists left the city and theoretical and artistic interests changed. For example, in 1968, Frieder Nake, a key figure of computational generative art in Stuttgart, moved to Toronto. In his substantial account of the intellectual and aesthetic history of the Stuttgart School published in 1974, Nake describes the dissolution of important constellations in the first years of the 1970s (Nake, 1974), as Max Bense shifted his interests away from information theory and computing, and focused on semiotics instead. Rul Gunzenhäuser, meanwhile, left poetic natural language generation behind and concentrated on establishing computer science as an academic discipline in its own right at the University of Stuttgart (Bernhart, 2019), and Theo Lutz started working full-time in the computer industry.

2.3 Constellations

In 1959, advised by Rul Gunzenhäuser and informed by Max Bense's research on information aesthetics, Theo Lutz conceived of a computational text generator and generated about 50 short texts on the mainframe computer Zuse Z22 at the University of Stuttgart's new computing center, to which his role as an engineer gave him access (Lutz, 1959). At the same time,

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[2]The network associated with these publications has yet to be reconstructed and was not part of the exploratory study described here.

he participated, together with Gunzenhäuser, in the Aesthetic Colloquium organized by Bense. The project of creating poetic *Stochastic Texts* brought together computer science, computational text studies or text statistics, and poetic production. In order to randomly pick words from a list, random numbers had to be produced, and Lutz developed his own pseudo-random number generator for the large mainframe. The generation of natural language mirrored certain problems of text statistics Bense was working on at the time based on Claude Shannon's propositions for the stochastic modeling of language (Shannon, 2003; Bense, 2000). Finally, the *Stochastic Texts* used vocabulary derived from the novel *The Castle* by Franz Kafka, simultaneously reproducing the uncanny in Kafka and producing the uncanny in the outcome of computational poetic natural language generation.

Conceptualizing, printing, processing, and publishing the *Stochastic Texts* can be described as a series of events that connects different actors (in this case Theo Lutz, Rul Gunzenhäuser, and Max Bense, as well as Elisabeth Walther and other editors of the magazine *Augenblick*), and also different fields of activity, namely computer science (which, at the time, was still called mathematics), information aesthetics, and literature.

Another exemplary constellation is Georg Nees's presentation of his early computationally generated art works at the Aesthetic Colloquium, a regular event attended by members of the University of Stuttgart (students and staff) and, sometimes, by artists and authors. For the presentation of the art works, Max Bense, who organized the session, invited Stuttgart-based artists, and there were always graduate and doctoral students in attendance. The Aesthetic Colloquium was a key event for presenting, testing, and discussing research in information aesthetics and, specifically at this event, generative art. The corpus put together for the empirical study contains two autobiographical descriptions of the event, one by Nees, the presenting artist, and one by Marion Röttgen, a graduate student at the University of Stuttgart at the time (Nees, 2005). Both accounts were written down or told to interviewers many years after the fact.

It is not a coincidence that both Lutz and Nees are men: women are underrepresented in the network. This is at least partly due to the fact that women in general were underrepresented in academia during the period in question as a result of academic and societal power structures. Another reason is the underrepresentation of women and their work in historical accounts and in the history of knowledge, and thus in the network data extracted from these accounts. In our interview, Marion Röttgen described the sessions of the Aesthetic Colloquium as partly collaborative work on the statistical analysis of art, including discussions about how to model certain aspects of

the works. Students (men and women) took part in these discussions and thus shaped the abiding discourse. On the level of the academic staff at the University of Stuttgart, Waltraud Reichert and Elisabeth Walther published substantial work on information aesthetics. Walther also played an important role as organizer and editor of the key journals *Augenblick* and *Grundlagenstudien*, and later became a professor at the University of Stuttgart. She archived, edited, and published many of the works of Max Bense, whom she married in 1988. Her significant contribution to the Stuttgart School Network through her research and editorial work has long been underestimated – at the German Literature Archive in Marbach, some of her papers are still sorted under the name of Max Bense. Reichert, on the other hand, worked on cybernetic drama analytics, publishing several essays and her doctoral dissertation on the topic (Reichert, 1965). Her work has recently been cited in the context of the new approaches to computational drama analytics that are being developed in the digital humanities (Trilcke, 2013). Both researchers and their connections, however, are not adequately represented in the network reconstructed in this case study, as 1) the corpus for this case study is still too small and needs to be extended (see 3.6), and 2) the work of both Walther and Reichert has only recently attracted academic attention.
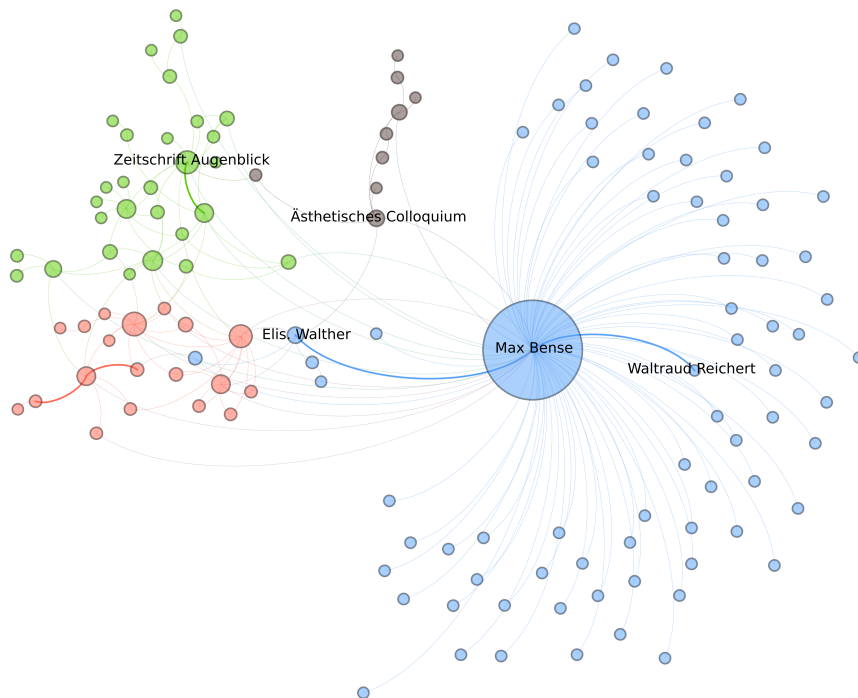

Figure 1: Stuttgart School Network

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The network visualization (Figure 1) contains only nodes with at least one connection (degree greater than zero). Nodes represent tokens of either of the four classes used ('person,' 'event,' 'institution,' 'publication'), while edges represent any type of connection as defined in the model. Edges are weighted according to the overall connection count. (There is, for example, more than one connection between Max Bense and Waltraud Reichert in the dataset.) Several very small unconnected subnetworks were omitted from the graph. Clusters (colored) were computed based on modularity (with edge weights and resolution value 2).[3] The network shows four distinct clusters: the green cluster contains the group centered around the magazine *Augenblick* and several protagonists of the concrete poetry movement located in or near Stuttgart at the time; the red cluster is centered on the 'Stuttgart Group' as defined by Reinhard Döhl (Döhl himself and Manfred Esser are part of this group); the grey cluster, the smallest cluster in the network, carries the label "Ästhetisches Colloquium" (Aesthetic Colloquium, see above); and the blue cluster represents Max Bense and the doctoral candidates he advised based on the sizable list of doctoral dissertations assembled by Elisabeth Walther.

3   Empirical Case Study

3.1   Where People Meet

The data model for the empirical study consists of four types of entities: persons (or actors), institutions, events, and publications such as the magazine *Augenblick* that brought together a range of different actors from the network. The network represents social contacts, which are defined rather broadly and range from documented collaboration to participation in the same event. Events are defined as singular events, for example the first exhibition of computer-generated art at the *Studiengalerie* or the presentation of Nees's artworks at the Aesthetic Colloquium. Institutions range from the fairly stable and permanent, like the University of Stuttgart, to the more ephemeral, like the Aesthetic Colloquium, which could be conceptualized as a series of events, but has instead been inserted into the institutions category as it was identified as an important regular institutional series of events in the corpus. The most important institutions are the locations where regular meetings, discussions, or exhibitions took place, such as the *Studiengalerie* of the University of Stuttgart, the Aesthetic Colloquium, and the bookstore

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[3]Additional research data (corpus bibliography, extracted network data, conversion script for Gephi ingestion, data model description) is available via Zenodo, DOI: 10.5281/zenodo.4908840. As this is an ongoing project, research data in the repository will be updated from time to time. The version pertaining to this essay is Version 0.9.

Niedlich – a hub for experimental literature and concrete poetry, which also hosted the first public exhibition of computer-generated artwork by Georg Nees and Frieder Nake. Finally, the 'publications' category contains mainly three elements: the magazine *Augenblick*, the book series *edition rot*, and the research journal *Grundlagenstudien aus Kybernetik und Geisteswissenschaft*. As it was beyond the scope of this exploratory study to fully encode the structural information that can be found in this category (such as co-authorship), the network does not contain any of the information that could have been extracted from the respective items.

When examined together, these elements combine into a medium-level multimodal historical network that provides an overview of the various groups or clusters, while serving as a useful basis for more microscopic questions regarding specific connections.

3.2   Corpus

The corpus used for the case study consists of 23 texts that can be categorized as the University of Stuttgart Archive's collection of newspaper articles related to Max Bense, autobiographical accounts of Stuttgart School protagonists, and historical research articles. The archive of the University of Stuttgart generously shared their collection of press articles published between 1969 and 2003 pertaining to Max Bense during and after his tenure as professor at the University of Stuttgart (1950–1978). A list of Ph.D. dissertations supervised by Bense, put together by Elisabeth Walther, is also part of the archive's Bense collection. This document plays a special role in the reconstructed network due to the large number of persons and connections it contains. In addition to this material, the corpus includes an autobiographical account by Georg Nees and an interview with Marion Röttgen which was conducted in 2018. Furthermore, two texts by Reinhard Döhl were added, which could be described as historical accounts containing autobiographical elements – as a professor of literary studies and an author who collaborated closely with Max Bense in both of these capacities, Döhl was himself part of the Stuttgart School Network. The dual role that becomes apparent here is, of course, far from unusual: as Klausnitzer has noted regarding the history of literary studies, historical accounts of scientific communities or, on a smaller scale, thought collectives, are often written by former protagonists. The methodological implications of this biographical connection between researchers and their objects of study for the history of science and the history of knowledge requires further reflection (Klausnitzer, 2001, p. 15).

It should be noted that the corpus is rather small. It may be possible to expand the reconstructed network by including metadata information extrac-

ted from the Stuttgart School publications and by adding more texts to the corpus. However, the goal of this case study was not to establish a *complete* network of the Stuttgart School, but rather to explore how a network-based approach could help to shed light on the lesser-known actors involved in it.

The small size of the corpus and the types of text it contains imply that the empirical network data retrieved from the corpus and the network constructed from this data need to be contextualized in order to acquire any explanatory value. But while the data and the graph cannot (as of yet) claim to be representative of the historical Stuttgart School Network, they have nevertheless allowed us to identify directions for further research on individual entities and clusters (see 3.6).

3.3 Data Collection and Processing

All texts of the corpus were digitized (PDF) and bibliographical data was stored in a bibliographical database in order to ensure access for everyone involved in encoding the data. Students taking part in a seminar on the broader cultural history of the Stuttgart School co-constructed and learned the data model and processed texts according to the encoding instructions. Network data extracted from the texts was collected in a collaborative spreadsheet and then converted to a format suitable for the network visualization software Gephi[4] using a Python script (Figure 2).[5]
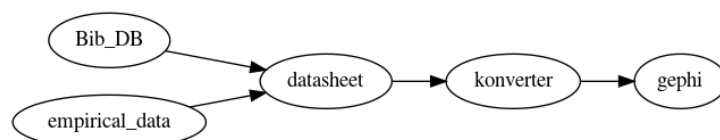

Figure 2: Dataflow

Information extraction was done manually using detailed encoding instructions with definitions and examples for each type of entity and for each type of relation. Encoding instructions were adapted in an iterative fashion during an initial modeling phase. Adaptations mostly pertained to the differentiation of properties, and to reductions where expected properties did not exist in the corpus. Information extraction yielded 135 persons or actors, 15 institutions, eight of which were once or are still located in Stuttgart, and 16 events that occurred in the time frame between 1964 and 1970. (The three key publications named above were set from the beginning for heuristic reasons.)

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[4]https://gephi.org/
[5]https://github.com/esthet1cs/nws_konverter

3.4 Data Model

In order to identify lesser-known actors of the Stuttgart School, the network is focused on persons with additional attention being paid to events, institutions, and publications. The basic structure of the model follows the assumption that thought collectives and their larger network are built through interactions enabled by events and institutions, while participation in the three publications central to the Stuttgart School Network signifies participation in debates and discourse (Stichweh, 1994). The main categories in this model have successfully been used by database or knowledge base projects looking to map or describe similar movements in art, culture, and the history of knowledge, for example the compArt database Digital Art (daDA) conceptualized, built, and run by Frieder Nake and his team,[6] and the knowledge base Monoskop.[7]

Idiosyncratic modeling – constructing a model that will be compatible neither with other models in the same area nor with existing standards in order to answer a specific research question – poses problems with regards to data re-use and interoperability. One main area of interest for historical research on the Stuttgart School Network is the early phase of digital art. The compArt database contains information about protagonists, institutions, events, publications, and artworks from this early phase (Figure 3).
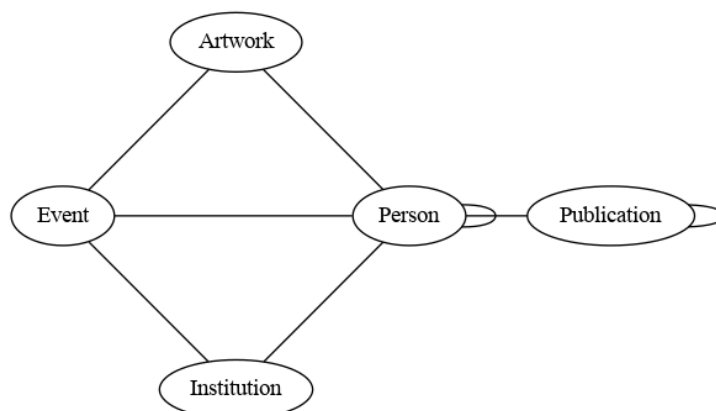

Figure 3: Nodes and relations. Entities of the type 'person' and 'publication' may refer to other entities of the same type.

However, using both datasets – Stuttgart School Network and compArt – would require a mapping of the two data models, which in turn creates a risk of semantic mismatching. It is noteworthy in this context that the Data for History Consortium is currently working on extensions to CIDOC

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[6] http://dada.compart-bremen.de/

[7] https://monoskop.org

CRM, the Conceptual Reference Model of the CIDOC initiative (Beretta et al., 2019; Beretta and Alamercery, 2020). As an object-oriented onto-logy that has been developed to accord with the needs of institutions in the cultural heritage sector, CIDOC CRM is highly extensible and several spe-cialized extensions exist.[8] One notable extension for application in the his-tory of knowledge is the Semantic Data for Humanities and Social Sciences (SDHSS) CIDOC CRM top-level extension, as it provides domain-specific classes and properties extending CIDOC CRM core classes like the Event class, e.g. for modeling historical social events.[9]

While the issues of extending models from one domain to others and of searching for ontological abstractions that can serve as points of reference for multiple domains or types of networks cannot be discussed here on a the-oretical level, they had to be addressed in practice with regard to the multi-modal approach of this case study: How far should we stretch the multi in multi-modal? Where do we stop? Should we analyze citation networks and add them as an additional layer? Should we try to extract network informa-tion from all publications that come up in our corpus texts? In our case, the reply to the latter two questions was "no" – citation networks are not inter-personal social networks, and not every magazine or journal is a key factor in the differentiation of disciplines, scientific communities, or thought collect-ives like the ones that make up the Stuttgart School Network. Only some publications function as hubs for a specific scientific community. For the Stuttgart School Network, earlier research has identified the relevant public-ations, and the network data extracted from the corpus did not suggest other publications of special importance, although more data is needed to verify this conclusively.

3.5 Observations

The Stuttgart School Network as visualized in this study consists of 210 nodes. 138 nodes are connected to other nodes, with 7 nodes forming small subnetworks that are not connected to the main network, which consists of 131 interconnected nodes. About 70 persons in the network were extracted from the list of dissertations supervised by Max Bense. Only some of these have a network degree greater than one. However, through verification of academic participation, e.g. in the Aesthetic Colloquium, more interconnec-

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[8] See the list of compatible models on the CIDOC CRM website: CIDOC CRM, Com-patible Models & Collaborations, `http://www.cidoc-crm.org/collaborations`.

[9] The SDHSS ontology has been published via the Ontome ontology platform: Se-mantic Data for Humanities and Social Sciences (SDHSS) CIDOC CRM Top-Level Exten-sion, `https://ontome.net/ns/sdhss-top-level/`, Version date 2021-04-21. See also (Beretta and Alamercery, 2020)

tions are likely to be found. In total, the number of interconnected nodes was larger than expected based on existing research on the Stuttgart School.

The most connected and central node of the network is the Max Bense node. This was to be expected, as a substantial part of the corpus consists of the University of Stuttgart Archive's collection of press articles and university documents pertaining to Bense and his work. Conversely, in some cases, the degree and centrality measure was lower than could be assumed from contextual information – the Waltraud Reichert node, for example, is only connected to the Max Bense node, although Reichert was a co-author and author of multiple scientific publications that had a notable impact. A higher degree and a more central position was also expected for the Elisabeth Walther node due to her editorial role for key publications of the Stuttgart School such as *Augenblick* and the works of Max Bense.

When examining the amount of connections extracted from the documents, it was found that some documents contained a substantially higher amount of data compared to others, particularly the list of dissertations. Other documents with a high data yield were historical or autobiographical accounts citing persons, places, and events, for example those by Reinhard Döhl. Given the small size of the corpus available for the exploratory study, the influence of these data-rich documents on the network was considerable.

3.6   Insights and Next Steps

Visibility: the network contains persons and other entities that might otherwise be overlooked. Although the network structure itself may not put these entities in the foreground, it helps to bring them into focus as part of specific clusters. Since the network reflects a corpus that is itself influenced by historical power structures, positions and measures of certain entities must be interpreted with care. Regarding the Stuttgart School Network, this is especially true for women, whose organizing role (Elisabeth Walther) and scientific contributions (Elisabeth Walther and Waltraud Reichert) have only recently received more attention from historians and literary scholars (Albrecht et al., 2019, p. 7).

Contextualization: research on the Stuttgart School or Stuttgart Group often focuses on certain fields, groups, or even individuals. The reconstruction of the Stuttgart School Network comprising persons, events, institutions, and specific publications associated with information aesthetics, computational generative art and literature, or concrete poetry, provides a more accurate picture of the extent of the historical network and allows the contextualization of specific subgroups or clusters within that network, like the concrete poetry group to which Reinhard Döhl belonged, or the group of

artists and researchers in information aesthetics that gathered around Max Bense. Thus, the present study provides both an overview of the network and detailed views of local historical constellations comprising persons, institutions, events, and publications at the nexus of aesthetics and poetics on the one hand, and cybernetics and information theory on the other.

As the case study has shown, more documents will need to be added to the corpus in order to produce more robust results. Strategies to extend the corpus and retrieve more empirical data in the future include the addition of all issues of the key publications determined through existing research, and the identification of more key events in written historical accounts and direct interviews with former protagonists of the Stuttgart School Network. Making the data available to researchers working in the fields of cultural history and the history of knowledge might lead to further interest in the subject and thus to further information regarding the network. In order to enable other researchers to re-use the network data and add more data points, the model will have to be refined and reformulated in relation to a reference model like CIDOC CRM.

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