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A combination of constellation analysis and MLP as a means for collaborative urban development

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1 Problem framing and methodological background

Participation and collaboration in (urban) sustainability transitions are regularly and normatively asked for (cf. WBGU, 2016). Transdisciplinary and collaborative research projects and practices have already developed a variety of methods to integrate knowledge from science and practice (DRIFT 2011; Scholz und Tietje 2002). A fruitful methodology for such an inter- and transdisciplinary knowledge integration and accessible communication between different stakeholders and their viewpoints is the constellation analysis (CA).

The CA has been developed by Schön et al. (2007) as a „bridging concept“ for technology, sustainability or innovation research. It can be used as a tool for knowledge integration, validation of preliminary research results, structuring of different perspectives and the development of strategies (Ohlhorst & Kröger 2015, Schäfer & Kröger, 2016, p. 528ff.). The CA allows heterogenous groups to map important actors, programmes, rules, resources etc., to in-terrelate them and to arrange them around a specific problem or area. The core idea of CA is that technological, natural and social developments are closely intertwined in postmodern knowledge societies. None of these factors is given an explanatory strength since it is the network of factors that determines a development. CA calls for an inter- and transdisciplinary research with regard to sustainability challenges and provides a toolbox to create figures of complex constellations and socio-technical systems.

The different elements are clustered into four main types: „actors“, „signs“, „natural elements“ and „technical elements“. Actors are e.g. persons, groups or organisations, technical elements are artifacts (e.g. power lines, machines), types of technical appliances (patents, high voltage current, software, etc.). Natural elements represent resources, air, water, soil, flora, fauna and natural phenomena while signs contain ideas, concepts, models, narratives, discourses, rules and regulation. Furthermore there are hybid elements, which are assemblags of at least two elements. During the CA, the elements are clearly distuingished from each other in order to get a general idea about the constellation, e.g. whether a certain element type is dominant (Best, Prantner, & Augenstein, 2012, p. 96). All elements can be so-called context elements which affect the whole constellation and cannot be changed by any transformation within it.

A CA sheds light on the relation between elements, which stems from relationist sociology. The CA-team has two possibilities to depict relations: the strength of ties is depicted by elements being positioned close or far from each other. The other possibility is to draw relations with a definition - single relations: elements are related, directional relation: one element has an impact on one other or several other elements, interactice relation: elements affect each other, conflicting relation: element is in conflict with one or several other elements, hampered/resistive relation: elements exert (passive) resistance against the influence of other elements, feedback relation: two elements are in a relation with mutual self-reinforcement.

Depending on the field of application and the research question, the analytical procedure of the CA is defined by checklists (Schön et al. 2007).

1. Mapping; identifying important elements and relate them

1.1. Collect elements and typify them

1.2. Map elements

1.3. Describe the relations between elements

1.4. Describe the structure of the constellation

1.5. Zoom into subconstellations

1.6. Pick a name for the constellation

2. Analysis and Interpretation of functional principles and characteristics of the constellation

2.1. Develop functional principles

2.2. Analyse characteristics of the constellation

2.3. Examine the normative power of elements

3. Assess the dynamics of a constellation

3.1. Analyse dynamics within a constellation

3.2. Analyse the dynamics of the context of the constellation

3.3. Analyse the stability of the constellation

Schön et al. (2007) recommend to playfully jump between the steps and also to invent other kinds of relations on function of the group dynamics and the ideas of the team. Also, there are several possible ways in which CA can be developed, depending on available time and team size. The whole team can pass all the steps, part of the team prepares maps to discuss them with the whole team or single members of the team prepare maps and discuss them with other team members.

The CA can be used for several purposes: (1) integration of different types of knowledge/results, (2) developing strategies, (3) analysis of governance of innovation processes and transformations.

Constellations are usually built from the centre. Most important elements are put in the middle, elements which are grouped aside are usually clustered and considered to be related (Schäfer & Kröger, 2016).

CA shares similarities with the multi-level perspective (MLP) that tries to analyse and explain long-term transformations and innovation processes in specific areas (Geels 2002). The strength of the MLP is its heuristic character, which allows for adressing complex and dynamic phenomena. At the same time, it leads to difficulties regarding the operationalisation in empirical studies. The MLP and derived graphical depictions are normally not based on a dialogue with practitioners and civil society, but rather reflect academic knowledge.

CA in turn does include a kind of „landscape“ elements like the MLP (called „context“) but does normally not allow an arrangement of the elements according to the „nested hierarchy“ as niche impulses or regime factors.

We therefore propose a mix of the two methods in order to achieve a comprehensive toolbox for effectful interaction of disciplines and practice partners. The idea of the

Multi-Level Constellation Analysis (ML-CA) is to visualise the elements of the MLP. While keeping all methodological steps the same, the CA-team would need to decide whether an element is placed on the niche, regime or landscape level.

We have applied the ML-CA in two empirical cases, both anchored on a sub-city level and focussing sustainable urban development and bottom-up contributions to it. The aims and functions of the methodology were different though, as described below.

2 A Tale of Two Cities

We conducted our case studies in two equally-sized cities in North-Rhine Westphalia (see figure 1 and table 1) which have been shrinking since the 1970s. The number of inhabitants is moderately increasing in both cities recently but will prospectively decrease during the upcoming decades, due to demographic change.

Fig. 1 Location of the cities of Bottrop and Wuppertal in North Rhine-Westphalia, Germany

Bottrop is the city with the last active stone coal mine in Germany, Wuppertal once was one the largest economic centres in the early capitalism with its main pillar, the textile industry.

Both cities are confronted with an enormous structural change and are embedded in structural policies of the federal state of North Rhine-Westphalia.

Table 1 Case studies conducted with the ML-CA framework

	Case Bottrop	Case Mirke
Location (City, area)	Bottrop, Northern Ruhr district	City district in Wuppertal, south of the Ruhr district
Population city / district (or pilot area)	365.000 / 69.000 (2015)	360.000/ 8.600 (2015)
Main challenges in district / pilot area	poor local public transport, high car-dependency low r&d-intensity in companies loss of local supply/suppliers active coal-mine (will close down in 2018)	high vacancy rate more than 50% of buildings are listed; renovation backlog integration (56% with migration back-ground, 2014) high unemployment rate (13,3%, 2014)
Project background	Research project (PhD) and other scien-tific evaluations of the project „Innovation City". Innovation City is a PPP establis-hed by the City of Bottrop and private Sector. Technologies and Strategies for the energy transition are brought into practical implementation since 2010. A special feature of the project is, that its roll out has already started. Duration of Innovation City: ca. 2010-2020	Project „Well-being Trans-formation Wuppertal" (WTW): Development of a city-wide alternative well-being indicator system and case studies in three diffe-rent districts which provide a detailed under-standing of the dynamics and key drivers for a sustainability transition in Wuppertal. Duration: 2015-2018

2.1 Case 1: Participation processes in the Innovation City Ruhr – Model City Bottrop

Bottrop is situated in the Ruhr District, one of the largest agglomerations in Europe, which also was one of the initial point of the fossil-based industrialisation. After 40 years of structural change, the large industrial heritage has been reduced or is reused for arts, festivals and tourism. The next step after this cultural transformation, which was partly realised by the decade project IBA Emscher Park, is the ecological trans-formation of the Ruhr Cities (Leggewie 2011). The actual flagship decade project of this transformation is called „Innovation City Ruhr | Model City Bottrop", which is implemented by a public-private partnership (PPP) in an urban laboratory in the City of Bottrop. Its strategic aims are the reduction of CO2-Emissions in the model region by 50% between 2010 and 2020 and the increase of the urban quality of life. The main lever for this reduction is assumed to be the energetic refurbishment in the existing housing stock as well as the deployment of technlogies, such as cogenerati-on, smart grid / smart city-infrastructures, electromobility, etc.

Table 2 Characteristics of the conducted ML-CA in Bottrop and Mirke

	Case Bottrop	Case Mirke
Form and time	3 Workshops November 2015 till March 2016	3 Workshops January till March 2017
Participants in CA	6 chosen actors who are in involved in Innovation City Background: 1 from the PPP, 2 from public administration, 2 from an ecology group, 1 scientist with a background in psychology	9 chosen actors who live and/or work in the district Background: 1 from politics (city council), 2 from public administration, 1 from a child and youth organisation, 1 active resident, 2 from a collaborative urban development office and 2 from the dominant local culture and creative hub; 4 additional interviews were conducted with local insiders
Researchers roles (based on proposed roles by Wittmayer & Schäpke, 2014)	process facilitator reflective scientist knowledge broker (self-reflexive scientist)	process facilitator reflective scientist knowledge broker (self-reflexive scientist)

2.1.1 Case description and context factors

Innovation City is an urban renewal project governed by a network of industry („Initiativkreis Ruhr"), public officials and scientists. The project is a show case for the implementation of low-carbon technologies in a city context and a success story for the energy transition in a formerly highly industrialised area. A multi-stage energy-related advisory service for private home owner has been introduced, the first stage being free of charge. An additional funding for modernisation is tested in the pilot region by the federal government („Förderrichtlinie 11.1"). Between 2010 and 2015, the rate of modernisation in the housing sector increased from 1% to 3% per annum.

The Wuppertal Institute closely collaborates with the Innovation City Management Company and other partners in the Ruhr district and concerns with socio-economic and technological challenges of the energy transitions in that region. Within this project cluster, „Energiewende Ruhr" (2013-2016) was a major-scale project, funded by the Mercator Foundation (http://www.energiewende-ruhr.de/). Innovation City is an umbrella for more than 300 single projects, ranging from pilot projects for smart home systems, electromobility testing schemes and research to educational projects in schools and kindergartens.

The civil society participates to some extend to the project: Ecology groups contributed with project ideas to the so-called „Masterplan", which is a compilation of potential projects edited by Albert Speer & Partner. Civic engagement also put a temporary urban gardening project of the city government on a permanent level in 2016. However, there is a substantial critique that Innovation City is an elitist project which is not fully inclusive and that would benefit from a more participatory design (Mattes, Huber and Koehrsen 2015). Between 2013-2016, Ben Best conducted his PhD-project in Bottrop, which included a temporary phase of living in Bottrop, participatory observation, interviews and workshops. The latter were a central tool for the development of the participatory ML-CA, which was applied for answering the question: „With regard to citizen participation: which development can be identified within the project Innovation City?"

2.1.2 Conducting the ML-CA in Bottrop

The three workshops were organised, prepared, documenented and facilitated by Ben Best. The participants were invited based on existing contacts in the pilot regions and they represent different elements: sign elements = public administration, natural elements = ecology organisation, routines/culture = scientist, technologies = Innovation City management representative (see table 2). The group members were gender balanced, but there was no representative with a migration background. There were five people in the team , most of them in their late twenties to thrierties and some senior participants.

Most of the times the atmosphere of the workshops was friendly and constructive. The team members also dealt with an existing conflict between the nature conservation groups and the representatives of the city administration: The ecology-team members opposed many cases where the city decided to fell trees. The outcome of this conflict constellation is that the ecology groups are always somewhat „outside“ of the core innovation-city constellation.

The development of citizen participation was divided in three phases of the gradual establishment of the innovation city project: 2009-2011: niche; 2011-2013: breakthrough and 2013-2015: establishment. The context / landscape-level has been replicated for all of the three phases. Elements described as niche were less influential or structured, but more open to participation of everyone. Regime elements were seen as more established and structured but less inclusive. Every phase contained more than 20 elements and up to three sub-constellations. The functions of the elements, relations and sub-constellations were described verbally by the CA team. A document with detailed descriptions and a simplification for every phase (see figure 2) was created by Ben Best. The outcome of this constellation analysis is part of his PhD project in Political Science at the University of Wuppertal.

2.1.3 Figures and findings

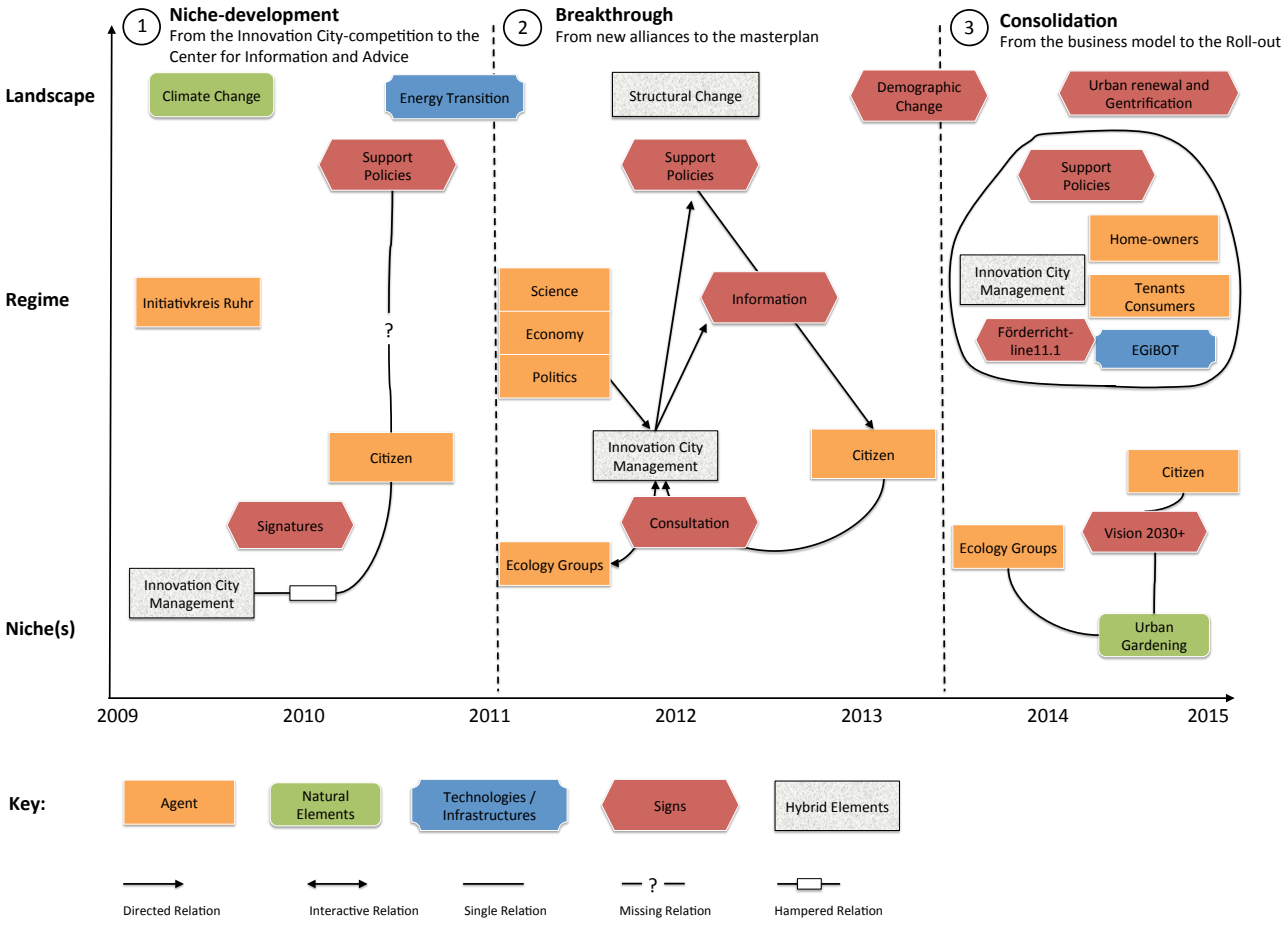

Fig. 2 Summary of 3 ML-CAs of the participation process in the City of Bottrop / Innovation City

1. 2009-2011: Niche development: From the Innovation City competition to the Centre for Information and Advice

In the first phase, Bottrop applies for the title of Innovation City in a competition by a network of industrial and economic actors in the Ruhr region. In Bottrop, 10.000 citizens express their support for application with a signature. This formed a source of legitimacy when Bottrop was named „Innovation City“ in 2010 and the Inovation City Management ltd. formed in 2011. This management company moved into the so-called Center for Information and Advice, which is thought as a one-stop consultation spot for sustainable urban development and energy efficiency in the building sector. For the implementation of the project, multiple networks with local crafts and trade, scientific institutions and political actors were formed.

In the CA, a missing link between the citizen and support policies for energetic refurbishment on the landscape level has been identified, resulting in a low access to these funds. Furthermore, there is a resistancy-relation between the management company and the citizen. The latter are refractory to the efforts of increasing investments in building restoration - one of the major aims of Innovation City. In this phase, the expectations on Innovation City are boosted by a newspaper hoax which promised 2,5 bn EURO as prize money. However, the competition of the „Initiativkreis Ruhr“ did not include any money. The named sum was the amount to be invested by the win-

ning city. This misunderstanding even increased the reluctance of the citizens to use their own money for the project aims.

2. 2012-2013 Breakthrough: From new alliances to the masterplan

The Innovation City manangement company grows out of the niche to the level of the socio-technical regime in a process of gradually establishing a stable sub-constellation. It is pushed and supported by a broad alliance of science, economy and politics, which creates a positive reinforcement within the sub-constellation of the Innovation City. Moreover, the manangement company exerts influence on the landscape level, opening new funds for modernisation in the housing sector.

In the course of this phase, new and free forms of energy consulting provide citizens with more information on the project and their potential contribution to achieve the targets of Innovation City. Numerous workshops in the pilot region enable all citizens to actively contribute ideas to the so-called masterplan „climate-just urban development". Within the logic of the ladder of citizen participation (Arnstein, 1969) these workshops count as „consultation" (i.e. level 4 of 8).

3. 2013-2015 Consolidation: From the business model to the Roll-out

The Innovation City management company moves further up onto the level of the socio-technical regime. In this phase, home-owners, tenants and consumers became elements within a stable subconstellation. They are the target groups of Innovation City and are activated. They align their behaviour along with the goals of the project. The main goal of Innovation City is to diffuse physical artifacts (products and technologies) in the pilot region, which is facilitated by additional funds for energetic refurbishment (Förderrichtlinie 11.1) and new consulting and information systems which offer detailed information on each building within the pilot region.

In this phase, a participatory niche has been formed along with the project „Vision 2030+" and an urban gardening project. It opens up new activities and visions that go beyond the operational fiels and the spatial limits of the Innovation City management company.

2.1.4 Findings

- Innovation City is a successful project with regard to its first aim (GHG mitigation). The basis for this success of the project is the mobilisation of home-owners, tenants and consumers for investments in energetic refurbishment through information, energy consultation and financial support.
- Citizens participate only to a very limited degree in political decision in the project. An increase in the energy refurbishment rate is possible without ambitious participation processes.
- The second aim, the increase of the quality of life in the pilot region, is poorly defined. The performance of Innovation City in this matter is not fully evaluated.

2.2 Case 2: District development in Wuppertal – Who develops district Mirke and how?

Wuppertal is situated south of the Ruhr District and is the economic and cultural centre of a city triangle. Its economy, in contrast to Bottrop, never relied on heavy industry but on chemicals, automotive and traditionally textiles. It was only little destroyed during WWII and counts 4.500 listed buildings. The city still tries to find its narrative and standpoint, looking for economic recovery, cultural and tourist appeal, sustainable development and attractiveness as an education location. Recently, different actors and stakeholders like the regional development agency, the newly elected mayor, the Wuppertal Institute, the University of Wuppertal, social and traditional entrepreneurs and others try to coin the narrative of the „Transformation Capital Wuppertal", including cultural renewal, sustainability goals, diverse and small-scale development of vacancies and districts, post-fossil mobility transformation, civic engagement and multiculturalism.

2.2.1 Case description and context factors

The second case is located in district Mirke, north of the city centre in Wuppertal. The district's population is younger, poorer and more colourful than Wuppertal's average. The number of retailers, industry and crafts is rather low. A variety of well-known social and cultural associations and centres are located in the district and are key to its development. Recently, a big open space (60.000 m²) that formerly has been used by industry and railway were focussed for district development. The owner is a national real-estate company that is owned by an international investment funds. That led to discussion about the „right to the city", investments for the common good and external vs. endemic development.

The Centre for Transformation Research and Sustainability collaboratively researches the dynamics in district Mirke since 2015 in the project „Well-being Transformation Wuppertal" (see table 2). During a second design phase for joint action, a reflexive, participatory ML-CA was proposed for answering the question of „who develops and has developed district Mirke in the last 10 years?".

2.2.2 Conducting the ML-CA in Mirke

The workshops for the CA were organised, prepared, documented and conducted by Matthias Wanner and a student assistant from TransZent. Participants were invited by TransZent as well, based on recommendations of team members of a local district forum. Participants were supposed to have different backgrounds and organisational logics, as well as an integrated overview of the development of the district since 2000 (see Table 2). No representative of the economic sphere could be found who was interested in taking part in the workshops. This is probably mainly due to the small amount of businesspeople in the district. Among them, an even smaller amount is actively engaged in issues of district development. The second workshop clearly showed that the group had accidentally forgotten to invite local actors with a migration background. The group wanted to invite one or two people who could fill this gap but no representative could be found in such short time. Instead, the two researchers from TransZent interviewed three different people from a newly opened intercultural club,

a self-organised centre for culture and education and an insider and doorman in the local scene of sportsbars, betting and gambling.

The final team consisted of nine people, living and working in district Mirke (see Table 2). They had different professional backgrounds and the age span was approximally between 35 and 60 years. Only three participants were women. The participants shared a liberal, left-wing worldview which is representative for the district. The atmosphere in all workshop was open, constructive and free of conflicts.

A constellation was drawn for three past periods: 1) around 2007; 2) around 2012 and 3) around 2016). Every ML-CA consisted of a superordinate level called „context“ (cf. „landscape“ in MLP) and a vertically structured open field: elements described as less influental and structured were attached to the bottom („niche“), elements which were seen as influental and structured were attached to the top („regime“). A key of the elements and relations employed can be found in table 3.

A final document with three central charts and some 40 pages of accompanying text was created by TransZent and was commented and slightly improved by the CA team. The document will be printed, distributed and presented to two local forums.

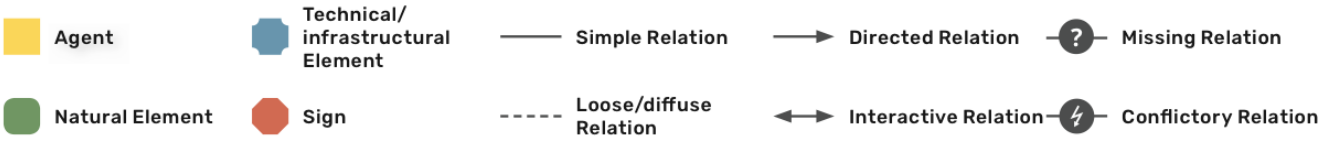

Fig. 3 Key of elements and relations employed in all ML-CAs in district Mirke. Blue elements were not only understood as technical elements but also as elements for infrastructure and buildings in an urban area.

2.2.3 Figures and findings

Three periods were depicted, each containing 56 elements in average (48 around 2007, 53 around 2012, 66 around 2016). Four clusters of agents, projects and ideas were identified as the basis for understanding the district‘s development: 1) culture, catering & retailing, 2) education, integration & youth empowerment, 3) trading-down processes and effects and 4) city development & urban planning. They show up in all three constellations. A fifth cluster emerges since 2011, bringing together creative small scale industries and bottom-up cultural and district development (figures 4 to 6).

1) Mirke around 2007: „the nameless rest of the district“

Throughout these years, district Mirke was seen as an „appendix“ of a neighbouring district which successfully initiated integrated recovery processes a couple of years before. The area of this district did not have an own name but was rather seen as the „other part of the Northern City“. Cluster 1 (culture, catering & retailing) lost influence during this period, due to closures of bars, well-known clubs and shops. The effects of cluster 3 (trading-down) remained on a high level since the city and shopping centre moved further away from the district, pulling out purchasing power and attention. Cluster 2 (education, integration & youth empowerment was quite stable

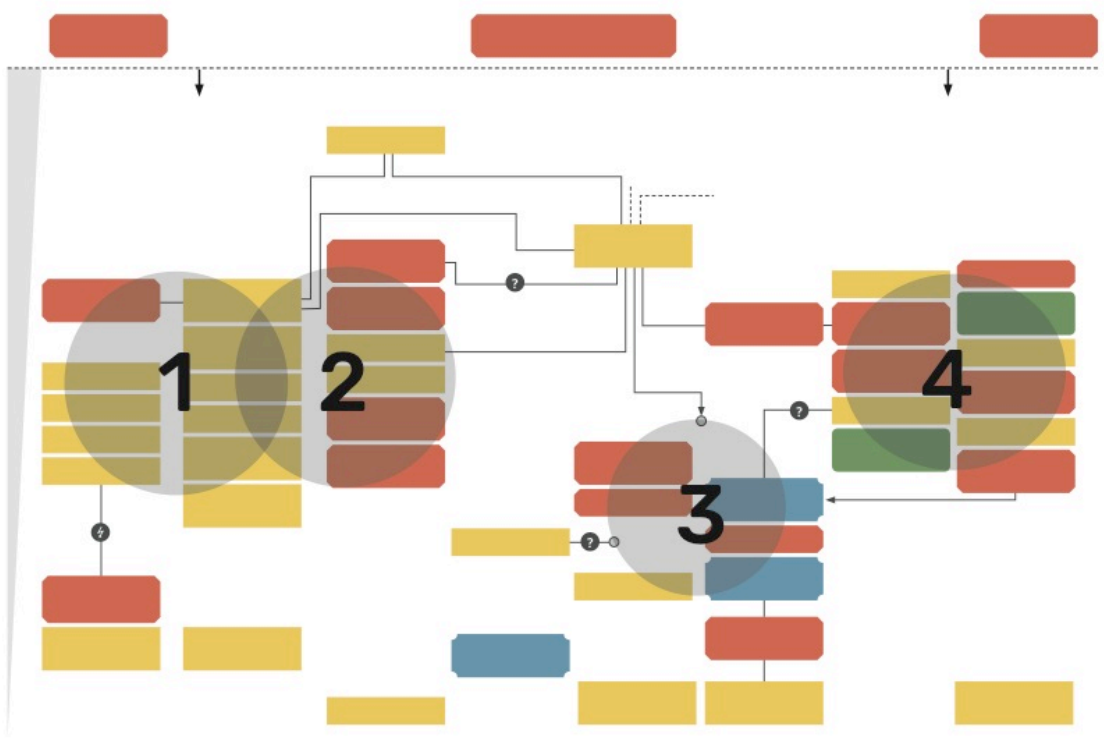

Fig. 4 ML-CA for district Mirke around 2007. Clusters are numbered, explanation in text. Elements do not contain inscription in order to increase clarity.

but structurally struggled with underfunding. Some niche actors like a local community of interest emerged but were not able to initiate stable activities. Apart from a high number of vacant flats, the abandoned railway infrastructure with the station „Mirke“ in its centre still posed an unsolved problem of district development. The influence of the urban development and planning increased in this period, due to the start of a 6 years long national funding programme for urban restructuring (2006-2012).

2) Mirke around 2012: „new actors, new name: district Mirke“

The second period shows slowly increasing importance of cluster 1. This is caused by new actors, new bars, exhibition spaces and some individual retailers. Cluster 2 is stable. Some new funds were secured but new challenges like an increasing poverty immigration from Southeast Europe tied up resources. Activities of the urban development and planning (cluster 4) could not solve main problems of trading-down processes in cluster 3. Additionally, the end of the already mentioned funding programme led to a decreasing presence and importance of administrational planning capacities. However, this constellation shows an emerging new cluster that is mainly organised and inspired by the multitude of cultural, political and social activities of Utopiastadt. New networks, forums and projects were launched. The cluster has strong links to clusters 1, 2 and 4. This momentum of interlinking and integrating different ideas of urban development like planning, cultural impulses, providing space for social networking, art and business are key to understand the importance and power of this new cluster. In plus, this cluster benefitted from the introduction of

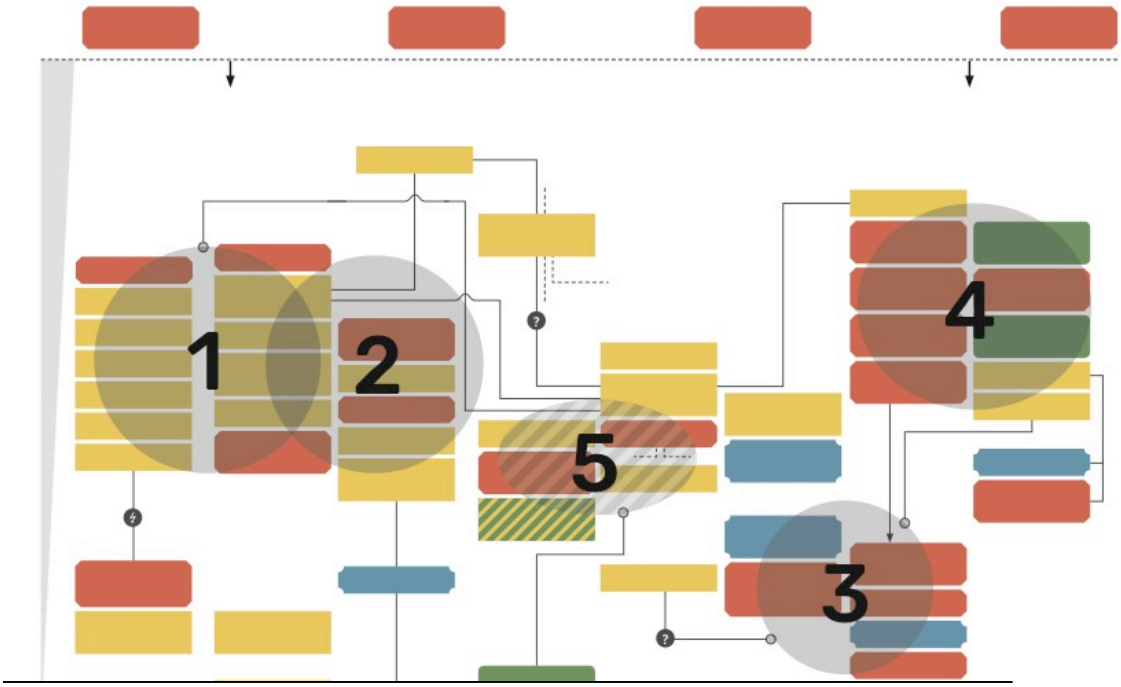

Fig. 5 ML-CA for district Mirke around 2012. Clusters are numbered, explanation in text. Elements do not contain inscription in order to increase clarity.

a new name and story: district Mirke with the historical station Mirke in its centre. The community-led conversion of the former railway to a rail trail was in full swing.

3) Mirke around 2016: „the district between uplift and constant challengens“

In this period one can see a stabilised cluster in the middle which grew out of the niche development of cluster 5 in the years around 2012. The cluster managed to extend the national funding for three more years and secured some more small funds like for example a district manager for integration. Do-it-yourself projects, gardening and repairing are also part of this cluster, always connected to social challenges in the district. Cluster 1 is still growing, benefitting from the fully converted and highly used rail trail. The trail connects formerly unconnected parts of the city and provides a new leisure area for all strata of society. Cluster 2 remains relatively unchanged. A growing problem is the constantly low funding with a simultaneously growing integration task for arriving refugees. Urban development and planning (cluster 4) steadily supports the bottom-up initiatives but seldomly provides own strong impulses. Cluster 3 still operates by a logic of its own, attracting „soldiers of fortune“ who try to reduce their poverty through gambling, betting, illegal work or crime.

2.2.4 Findings

- District Mirke is mostly developed by social and cultural activities. City development supports local actors to some extend but does not provide stable and influential impulses for district development. Business does not

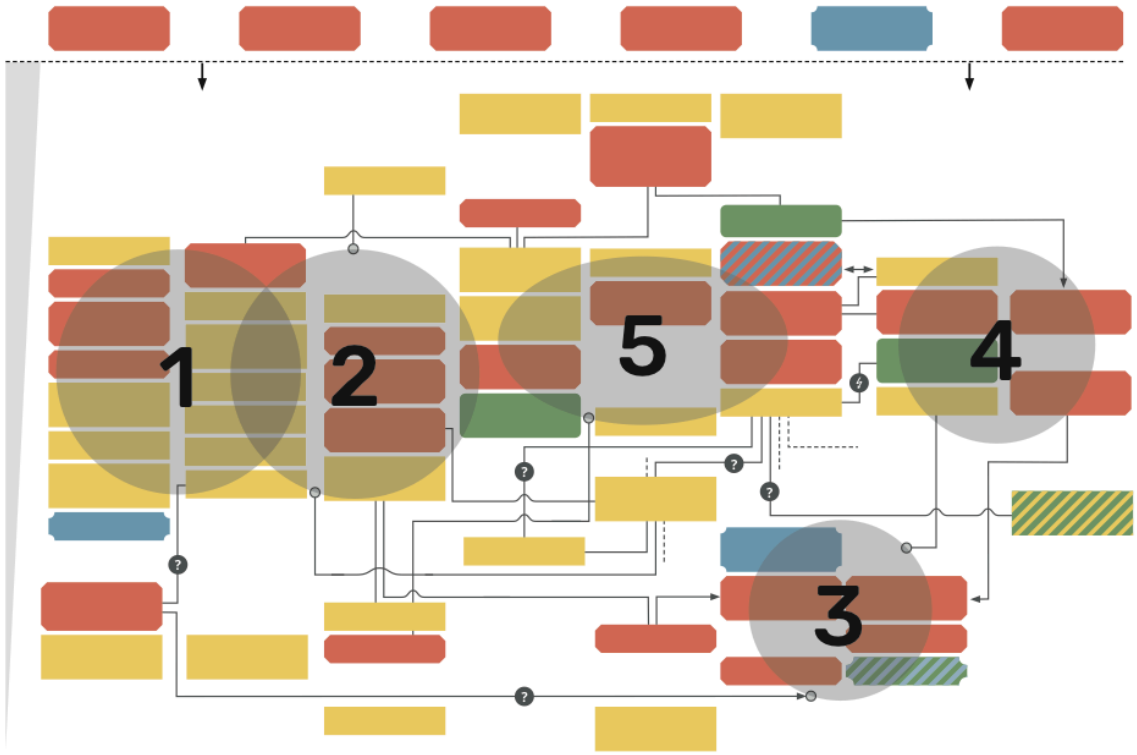

Fig. 6 ML-CA for district Mirke around 2012. Clusters are numbered, explanation in text. Elements do not contain inscription in order to increase clarity.

contribute substantially to the district's development and therefore is not represented as an own cluster.

- The agent Utopiastadt became an important organisation for district development, moving from niche to regime level over the monitored period. One main reason for this quick development was the ability of Utopiastadt to integratedly connect to the existing clusters of „culture, catering & retailing", „education, integration & youth empowerment" and „city development & urban planning".It was shown that there are still very few connections to cluster 3 („trading-down processes and effects"), leaving behind the economic and social trading-down problem rather isolated.

3 Combined reflection and recommendations

The detailed case descriptions in section 2 provide learnings on a methodological level and opportunity for reflection about the CA-ML as a tool for transformative and transdiscipliary research.

Best, Prantner & Augenstein already reflected on the combination of MLP and CA. After a theoretical integration of both concepts they formulate five points of criticism (2012, p. 103). In table 3, we deal with these five points and give useful recommendations for applying the ML-CA.

Table 3 Learnings from the two case studies in Bottrop and Mirke.

Point of criticism	Handling in case studies	Recommendations for researchers and practitioners
„[...] the visualization is a static observation [...]. As dynamic constellations are difficult to visualize [...] it can be useful to map constellations at various points in time.“	Both cases generated „snapshots“ of the situations for three points in time. Putting them side by side the development gets clear which, according to the practitioners helped a lot for understanding the dynamics of the situation.	Pick some meaningful points in time in order to depict the development of a constellation.
„[...] The visualization and interpretation process gives leeway to the participating experts. Equal [levels of hierarchy] should be kept in mind.“	Workshop participants in district Mirke did not show any difficulties with respect and credibility. Many of them already knew each other. In Bottrop, the representative from civil society was missing during the third workshop. Participants had to interprate his role and had difficulties doing so.	Participants should be chosen carefully. Willingness to work with the other participants should be clarified. No stark differences in hierarchy should exist. Facilitation has to take care of balanced shares of conversation and mutual respect.
„[...] The composition of the analyzing team may have an influence on the final picture.“	This was true in both cases. The final pictures would have looked different with a different group.	It should be kept in mind that the ML-CA is no tool for depicting the only true representation of a constellation or a problem. The participatory ML-CA rather creates a process for mutual understanding and the agreement on one possible, feasable and accepted representation.
„[...] only the most significant relations should be pictured in the final constellation.“	In both cases, especially in Mirke, many details were included in the ML-CA, leading to representations which cannot be grasped at a glance.	The CA team has to decide what’s more important: a detailed overview that provides a full picture of a constellation or a short description of the essentials. Both can be helpful, according to the project’s goal.
„[...] however, solutions are not always automatically derived from the graphics. Therefore, it is important to refrain from the constellation, to abstract, and to concentrate on the leading questions of the work phase.“	In both cases, three workshops were not enough to go through all three points of time again in order to abstract and refine the constellation. Having in mind the ideal-typical process mentioned in chapter 1, we both got stuck somehow at the beginning of step 2 (Analysis and Interpretation of functional principles and characteristics of the constellation).	Normally, more time is needed to boil down the mass of elements to the core points. Be aware that the integration of the MLP takes time, too. We suggest to include the step of arranging the elements according to their relevance and structuration during step 1.2 and 1.3 (see chapter 1).

4 Conclusion

Drawing on insights from our two cases, we see the ML-CA as a helpful tool for transdisciplinary and transformative research. The method involves actors in a process of (self-)reflection and clarification. This process and conversation can help to understand the complexity of (other) actors, institutions and elements involved in a transition process. The group work of the ML-CA stimulates role-taking and mutual understanding among the team members. The knowledge drawn from the constellation can help to design interventions and is therefore an interesting tool for stages of systems analyses in transdisciplinary and transformative research processes like real-world laboratories (Wanner et al., 2017). At the end of a full ML-CA with a clear understanding not only of the arrangement of the elements but also of power dynamics and hierarchies, it is a lot easier to identify leverage points for intervention.

Care should be taken with time, selection of team members and facilitation. Participants as well as researchers should benefit from taking part in workshops. That includes not only fruitful (new) knowledge or insights but also financial compensation for contributing their knowledge and time.

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