One-structure-fits-all or how the specific identity of the Permaculture movement fits into the general structure of the networks

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Degrowth is the socially sustainable and equitable reduction of society's throughput. A central piece in the degrowth puzzle is attributed to Permaculture. Indeed, many unanswered questions persist concerning Permaculture. This article answers the following research questions: What is the semantic network of the Permaculture movement? What is the hyperlink network of the Permaculture movement? We hypothesize that the semantic network and the hyperlink network will reflect the specificities of Permaculture and we wonder to what extent the semantic network influences the hyperlink network. The results show how the specific identity and semantic network of the Permaculture movement fits into the general structure of the online networks. Hence, one-structure-fits-all seems valid in the context of online social networks.

Une structure universelle des réseaux ? Ou comment l'identité spécifique du mouvement Permacol se conforme à la structure générale des réseaux

La décroissance est la réduction socialement durable et équitable de la cadence de production de la société et une pièce centrale du puzzle de la décroissance est attribuée à la Permaculture, en tant que une 'Nowtopia', une sortie alternative et radicale de l'économie et pour son potentiel de création de communautés locales, durables, et résilientes. De nombreuses questions sans réponse persistent concernant la Permaculture et cet article répond aux questions de recherche suivantes : quel est le réseau sémantique du mouvement de la Permaculture ? Quel est le réseau d'hyperliens du mouvement de la Permaculture ? Nous supposons que le réseau sémantique et le réseau d'hyperliens reflètent les spécificités de la Permaculture et nous nous demandons dans quelle mesure le réseau sémantique influence le réseau d'hyperliens. Pour trouver une réponse à ces questions, nous employons des méthodes de recherche non invasives. Les réponses sont détaillées dans cet article en fournissant, d'une part, une présentation du cadre théorique du réseau sémantique et du réseau d'hyperliens. Les résultats montrent comment l'identité spécifique et le réseau sémantique du mouvement de la

Permaculture s'inscrit dans la structure générale des réseaux d'hyperliens en ligne. Par conséquent, il apparaît que une structure universelle des réseaux semble valable dans le contexte des réseaux sociaux en ligne.

Introduction

Degrowth is the socially sustainable and equitable reduction of society's throughput (Kallis, 2011). A central piece in the sustainable degrowth puzzle is attributed to Permaculture, as an alternative radical 'exit from the economy' (Kallis, 2011) and degrowth Nowtopia (Carlsson & Manning, 2010), for its potential to create sustainable, local, self-reliant, community economies (Curtis 2003; Larrère *et al.* 2016).

Permaculture is the portmanteau of 'permanent agriculture' and was first defined by its founding authors, Mollison and Holmgren, as 'an integrated, evolving system of perennial or self-perpetuating plant and animal species useful to man' (Mollison and Holmgren, 1978, p. 1). Permaculture is united and characterized by its approach to system design (Ferguson & Lovell 2013). Over time, the domains of Permaculture application extended potentially to cover any physical and energetic resource use and organization from the local to the international level (Holmgren, 2002). For several authors, the 'Permaculture' portmanteau has lost its link to the cultivated fields of agriculture (from Latin *agricultura*, *ager* field + *cultura* cultivation) to refer more largely to permanent culture (Permanent Culture Now, 2014; Pezrès, 2010) and a holistic life system (Marrewijk and Werre, 2003). Additionally, Permaculture is making significant breakthroughs: looking at the first performance evaluations, Permaculture seems a promising and sustainable innovation, economically (Guégan, Léger, Chapelle, & Hervé-Gruyer, 2013; Shepard, 2013) ecologically (Rhodes, 2012; Shepard, 2013) and socially speaking (Shepard, 2013).

Permaculture tends to be unexplored by academics (Lockyer and Veteto, 2013) and practitioners: 'there has been little hard, rigorous scientific research and few peer-reviewed papers published on the subject' (Rhodes, 2012, p. 426). Indeed, the Permaculture movement participates in the larger social entrepreneurship movement which is becoming increasingly important worldwide (Dey,

2006), but social entrepreneurship seems yet under-investigated (Dacin, Dacin, & Tracey, 2011). Many unanswered questions persist about these radical 'exit from the economy' alternatives or degrowth nowtopias (Kallis *et al.* 2012). Knowledge gaps turn upon the motivations, characteristics, and political engagements of the militants for these alternatives, the ways they collectively organize, network, and protect themselves, the conditions for the success and scale-up of these alternatives, their relationships with outsiders (Kallis *et al.* 2012), or the alignment between the practice of these alternatives and sustainable degrowth theory (Martínez-Alier 2012).

Among all these relevant research gaps, this article answers the following research questions: What is the semantic network of the Permaculture movement? What is the hyperlink network of the Permaculture movement? We hypothesize that the semantic network and the hyperlink network will reflect the specificities of Permaculture mentioned above. Additionally, we wonder about the extent to which the semantic network influences the hyperlink network. To find an answer to these questions we employ unobtrusive research methods as the most appropriate to study non-conscious beliefs and visions as these methods do not interfere with the social movement members' normal behavior. Indeed, our study aims at contributing also to the enrichment of the application of these methodologies because only a few studies of online social movements use unobtrusive research methods to collect digital traces of their characteristics (Ackland & O'Neil, 2011).

The answers are given in detail in this article by first providing, a presentation of the theoretical framework. The following section describes the methodologies employed to analyze the two networks. Next, the results for the two networks are presented. Subsequently, the results are discussed showing how the Permaculture movement's specific identity fits inside the general structure of online social networks.

Online networks of social movements
Permaculture could be defined as a social movement (Ferguson and Lovell 2013) under the following definition: 'networks of informal interaction between a plurality of individuals, groups and/or organizations, engaged in a political or cultural conflict on the basis of a shared collective identity' (Diani 1992: 13).

In addition, the Internet has given social movements new tools to support their engagement (Laer & Aelst, 2010). In line with previous tradition (Ackland and O'Neil 2011), we consider an online social movement as an online grouping of actors who are participants in a social movement. Indeed, Internet and social media play a prominent role in facilitating social movements' communication, coordination, and development (Ackland and O'Neil 2011; Conover *et al.* 2013; Laer and Aelst

2010).

The Permaculture movement, like many other social movements, has a big presence online. The Permaculture movement, for example, took advantage of the Internet to strengthen its presence beyond the borders of Australia, where the Permaculture movement was born in the 70s. Today, we can even find a complete two-week training program online to obtain the Permaculture Design Certificate (PDC), which is the principal Permaculture training course, already followed by hundreds of thousands of people (The Food Forest, 2016).

Among the different manifestations of social movements on the Internet, social networks are taking central stage. Off-line social networks have long been recognized as playing a central role in the formation of social movements. Online social networks are playing a similar role in the recruitment of participants, internal organization and international construction building (Ackland and O'Neil 2011). In 2011, the Permaculture Research Institute, based in Australia, launched the Worldwide Permaculture Network, at the web address permacultureglobal.org. It offers two main services. Users can publish their own User Generated Content (USG) and can read others' UGC (Shriver *et al*. 2013). Users can also engage in social networking activities (Shriver, Nair, & Hofstetter, 2013), by choosing users and Permaculture projects to follow. Given the centrality of online social networks for social movements, this network study facilitates the understanding of the social movement itself.

Online semantic network

We leverage the frame concepts drawing on semantic network studies in organizational science, where network concepts are associated with interpretive methods, to understand linkages based on shared interpretations (Jablin and Putnam 2013; Stohl 1993). The online frame network is the application of the frame network to online content (Ackland & O'Neil, 2011). The primary aim of the frames is not practical, but symbolic. Frames are used to communicate disinterested, unconscious beliefs and visions and are a means of expressing collective identity. They are thus more particularly able to indicate proximity between actors (Ackland & O'Neil, 2011). Online frame networking does not put practical resources into play. Online frame development, by using a set of terms rather than other terms, is a purely symbolic action. The choice of terms is also unconscious (Ackland & O'Neil, 2011), allowing the emergence of deeply rooted collective identities.

Hyperlink network

Additionally, an online social network regularly takes the form of a hyperlink network. The

hyperlink is commonly observed as the essence of the web (Foot *et al.* 2003; Jackson 1997). In practice, the hyperlink network is based on the HTML hyperlink function which allows a tie to be established among webpages or websites. Among the possible functions and interpretations of a hyperlink network, studies show that hyperlink networks facilitate the exchange of practical and symbolic resources (Ackland and O'Neil 2011), by amplifying messages. On the other hand, hyperlinks could be considered a proxy for the 'we-ness' of the social movement (Ackland & O'Neil, 2011). This 'we-ness' is considered central to the definition of the collective identity, which seems to play a significant role in the development and resilience of social movements (Ackland and O'Neil 2011). This exchange of symbolic resources by hyperlink networking is a sort of conscious behavior to the extent that the social movement members deliberately decide the webpages and websites to link to (Ackland & O'Neil, 2011).

Moreover, the ease in modifying, deleting, and creating hyperlinks as well as the general publicity of hyperlinks has important implications (Ackland and O'Neil 2011). Indeed, the hyperlinking could be interpreted as a means of establishing boundaries of belonging, by linking to certain destinations and not others (Ackland & O'Neil, 2011) and criticizing authority by not linking to some other destinations (O'Neil, 2009).

In addition, large-scale hyperlink networks seem characterized by power laws (Barabási and Albert 1999) implying a high degree of network centralization. Similarly, sparsity (Clauset *et al.* 2009) and clusters are also patterns that emerge from the relationships that exist between individuals (Leskovec and Horvitz 2008; Myers *et al.* 2014).

This emergent and interactional perspective provides a theoretical ground for examining how individual attributes and behaviors lead to the emergence of group attributes (DeRue *et al.* 2015). The group attributes include the leadership issues, as also leadership is hence not a fixed group attribute (DeRue, Nahrgang, & Ashford, 2015). On the one hand, density could represent the amount of leadership exhibited within a group. On the other, centralization could be seen as a proxy for the distribution of leadership among the group members (DeRue, Nahrgang, & Ashford, 2015). Previous studies show that leadership in social networks is codetermined by UGC and social ties (Shriver *et al.* 2013).

Additionally, online social networks are potentially subject to network effects in content generation: the extension of the social ties of a member in a social network may influence the content posting behavior of this same member, producing a self-reinforcing virtuous cycle. Several individual motivations could strengthen this virtuous cycle, such as altruism or willingness to improve own

social status (Shriver *et al.* 2013).

This network effect impacts the pattern of distribution of UGC pattern, which, in the end, seems to follow the so-called participation inequality or '90-9-1' principle (Ochoa and Duval 2008; Shriver *et al.* 2013). We also question the extent to which the physical distance between members influences social ties (Goldenberg 2009).

Unlike online frame networking, hyperlink networking also brings practical resources into play. The choice of hyperlinks is also more conscious than frame networking (Ackland & O'Neil, 2011), allowing the emergence of organization and the structure of the Permaculture social movement. The members are a resource of the social movement (John D. McCarthy 2000) and the hyperlinking is an aspect of the structure of the movement (Clemens 1996).

Material and methods

Our unobtrusive research methods involve the analysis of the online content of permacultureglobal.org without interaction with the principals in charge of the social network (MCCAUGHEY & Ayers, 2013; Shumate & Dewitt, 2008) and their members. Two complementary sets of techniques are chosen to analyze the hyperlink network and the semantic network.

Method for the semantic network

To understand the semantic network, we principally levered the IRaMuTeQ computer assisted qualitative data analysis software (Del Corso *et al.* 2015; Delattre *et al.* 2015; Plumecocq 2014) for the analysis of UGC available on the permacultureglobal.org website.

We analyze the autobiographies of the members and their updates. First of all, we enrich UGC with meta-data. These meta-data provide information about our variables of interest: the author of the content, the gender of the author, and the user badges of the author. User badges are a set of attributes, predefined in the website, the users can select when describing them-selves. The user badges, sorted in alphabetical order, are: Aid Worker, Consultant, Looking for partner, PDC Teacher, Permaculture Research Institute (PRI) PDC Teacher, Trained Member.

Subsequently, lemmatization is executed in IraMuTeQ. Further, each term is classified based on its form. Active form refers to content words, like nouns, verbs, and adjectives, while supplementary form is about function words, such as prepositions, articles, some frequently occurring verbs and adverbs. The main analyses are run only on the active form terms. Finally, each text is broken into Elementary Context Units (ECU) and Context Units (CU). ECU are text segments of several consecutive lines that should contain a minimum number of words (15 by default) and are generally

marked off by punctuation. CU are concatenations of consecutive ECU containing a minimum number of active forms (12 by default).

Once this above mentioned process is complete, similarity analysis (Flament 1962) and Alceste method (Reinert 1983) are performed.

Method for the hyperlink network

To understand the hyperlink network we measured (1) the distribution of UGC (Shriver, Nair, & Hofstetter, 2013), (2) the codetermination of UGC and social ties (Shriver *et al.* 2013), (3) the codetermination of geographical location and social ties (Goldenberg and Levy 2009) and the sparsity (Clauset *et al.* 2009) and the clustering of users (Leskovec and Horvitz 2008; Myers *et al.* 2014).

About the distribution of UGC, we explore the pattern of the content generation for the Permaculture online network and we consider how close this explored pattern is to the so-called participation inequality or '90-9-1' principle (Ochoa & Duval, 2008; Shriver et al., 2013). Concerning the codetermination of UGC and social ties, we consider whether the common network effect pattern (Shriver et al., 2013) takes place also for the Permaculture social network. As concerns the codetermination of geographical location and social ties, we question the extent to which the physical distance between members influences their social ties (Goldenberg 2009). Finally, concerning sparsity and clustering, we look at the distribution of the social ties, the degree of centrality of the members, and the average local clustering coefficient to understand the extent to which the specificities of Permaculture influence the power laws for the degree of distribution (Clauset et al., 2009) and the clustering coefficients (Leskovec & Horvitz, 2008; Myers et al., 2014).

Material

Our online social network is the network extracted from the permacultureglobal.org website. Data collection of UGC and social ties was completed in September 2015. At the time of data collection, there were a total of 16,446 registered users. 63% of the users, declaring their gender, were male, and 37% were female. Out of the 13,407 users stating their geographical location, the United States is the most popular country in the network, with over 4,000 users. The site has been growing steadily from the very beginning. About ten new users join the social network every day. The site averaged around 15,000 unique visits per month, with visitors staying on the website for an average of 2 minutes and 20 seconds and viewing 2.7 pages each (SimilarWeb 2015).

Results

Results about semantic network

The autobiographies of the users combined with the updates posted by the users about their biographies give a total of 6,154 valid UGC entries, 1,129,005 lemmatized occurrences and 33,000 different forms. The average UGC entry contains 183 occurrences. A single form appears on average 34 times, but 16,585 forms (50.26% of the total) appear only once.

The similarity analysis over the whole autobiographic corpus highlights the strongest relationships between terms according to the Chi-square of association (Figure 1).

[Figure 1 here]

The Alceste classification procedure yields 5 classes. The first class (19.8% of the total ECU) has, as its term, 'PDC', after the term 'Permaculture'; so we refer to this class by the term 'PDC', as 'Permaculture' is redundant as a term for a semantic network about Permaculture. The second class (17.1%) has 'plant' as its first term; so we refer to this class by the term 'plant'. The third class (18.2%) has 'university' as its term, after the term 'Permaculture'; so we refer to this class by the term 'university'. The fourth class (19.6%) has 'human' as its first term; so we refer to this class by the term 'human'. The fifth class (25.2%) has 'me' as its first term; so we refer to this class by the term 'me'. Globally, the 5 classes altogether include 23,314 ECU (72.51% of the total).

The Chi-square of association between the class and the modalities of the variables is provided in Table 1. The first column of the table provides the name of the variable, the second column the modality of this variable associated with the class. The third column presents the Chi-square of association with this class. The fourth column shows the number of ECU associated with the class which are encountered in the autobiographies. The fifth column shows the total number of ECU in the autobiographies across all classes. The sixth column gives the corresponding percentage of the number of ECU associated with the class, against the total number of ECU across all classes. Finally, the seventh column gives the corresponding significance level. Finally, variables and modalities associated only with one class appear in bold, while variables and modalities more strongly associated with another class appear in italics.

[Table 1 here]

Results about the hyperlink network

Concerning the hyperlink network, our first measurements concern the distribution of the UGC. Out of the 16,446 registered users only 1,349 users post an update for a total of 5,442 posted updates, which gives an average of 4.04 updates per publishing user. Moreover, out of the 1,349 posting

users, more than 25% of them posted only one update and half of these 1,349 posting users posted 2 or less updates. As a complement, 75% of these 1,349 posting users posted 4 or less updates, which means that more than 75% of contributors had produced less than the mean number of updates. This means the remaining 25% of the posting users have posted the majority of the posts. Finally, a skewness of 7, high and positive, means that the distribution has a right long tail. This tail ends up at 106 updates for the most publishing user.

To visualize the analytical findings the data was plotted with logarithmic axes such as size-frequency plot (Figure 2). The shape takes the characteristic long tail distribution plotting an almost-straight-line giving a publication function which is strictly decreasing. At the end, the tail becomes wider and noisier. This effect is due to the discrete nature of the data, inasmuch as a post can only be produced by one user, and also to the fact that at high production numbers, it is difficult to find two users with the same amount of published updates. The linear or almost linear shape of the log-log size-frequency plot suggests that the data follow an inverse-power law, or similar, distribution. We conclude that UGC is very asymmetrically distributed among the users.

[Figure 2 here]

About the codetermination of UGC and social ties, we measured the correlation between UGC and social ties. The Pearson product-moment correlation coefficient is equal to 0.102 (t =7.16) and it is significant at the 0.01 level. In terms of social ties, we identified an outlier in Geoff Lawton, founder of permacultureglobal.org and successor of Bill Mollison in the direction of the PRI. By excluding Geoff Lawton, the correlation is higher by 0.428, with a t= 33.05 and still significant at the 0.01 level.

With regard to the codetermination of geographical location and social ties, we measure the distribution of the geographical distances of the users from their followers. The empirical distribution is consistent with a scale-free power law distribution. The best power law fit to the empirical data has an exponent of -0.84 and an R-squared of 0.52. The social ties are largely with other members from the same geographical location, with only a fraction including people geographically far away.

For sparsity and clustering, we counted 27,574 social ties of members following other members. It makes on average 1.67 following social ties per user (called average degree), with a maximum of 231 people followed by one single person and 3,866 people following the same person - the above mentioned founder of this online network.

The sparsity of the network does not, however, imply that users are far from each other in the

permacultureglobal.org network. While most pairs of users are not directly connected to each other, nearly half of users are connected in the biggest network component. In this component the paths to reach a user have on average a length of 5 and a maximum length of 14, called the network diameter. Indeed, this half of the network gathers the users who established social ties by following other users of the network, totaling 99.92% of the social ties of the network. The other half of the users are not gathered in one common component and hence there are no paths to reach them from the biggest network component. These smaller components are in general stand alone users (8,768 cases) or very small components (20 cases) made of 2 or 3 nodes.

The average clustering coefficient is very low at 0.062, signaling that many potential ties are missing. For the users with social ties, the clustering coefficient is equal to 1 for only 106 users, which means that these 106 nodes have the highest possible density of ties within their neighborhoods. The average clustering coefficients then decrease following a power law curve, with an exponent of -0.7 and an R-squared of 0.78.

Discussion

The semantic network

By looking at the most frequent active form terms in the autobiographies, we understand that the most important themes are:

- The practice of Permaculture, by the very frequent terms: work, project, build...

- The intellectual and learning activities to understand Permaculture, by: design, course, PDC...

- The agricultural domain of application of Permaculture, by: farm, garden, food...

- The openness of Permaculture to other domains beyond agriculture, by: community, live, person...

These points could be considered the leitmotivs of the collective identity of the Permaculture network members. The practice of Permaculture could be traced back to 'the prime directive of permaculture: 'The only ethical decision is to take responsibility for our own existence and that of our children. Make it now' (Mollison 1988: 1). The intellectual and learning activities are a semantic frame that is central for Permaculture network members. Indeed, these intellectual and learning activities have also been clearly recognized by the permaculture founders: 'permaculture design systems are information and design intensive […] A large part of the thinking revolution involves the emergence of design as a universal skill alongside those of literacy and numeracy'

(Holmgren 2002: 13–14). The application domain of Permaculture is related to the origin of Permaculture in agriculture. From the very beginning Permaculture directed its attention mainly toward proposing and developing agricultural practices. The first published Permaculture book subtitles 'A Perennial Agriculture for Human Settlements' (Mollison and Holmgren 1978) is clear evidence of the original relationship. At the same time, members write extensively and recurrently about the application of Permaculture to other domains beyond agriculture.

As a complement, the Alceste method gave us the potential to understand the five different discourses in the permaculture network held by different members. Beyond the common identity surrounding the most important themes from the co-occurrence and similarity analysis, the Alceste method uncovered a few sub-identities around different types of members (Ackland & O'Neil, 2011).

The first class links together Permaculture training terms: Permaculture Design Certificate (PDC), 'course', 'design', Geoff Lawton (Permaculture teacher, apart from being the founder of permacultureglobal.org social network). Looking at the variables, this class is particularly expressed by members who are not formally trained in Permaculture and to a lesser extent by Permaculture consultants and official Permaculture teachers. Combining these terms with the studied variables we realize the existence of a sort of dialog between untrained people and teachers and consultants.

The second class links together gardening terms: 'plant', 'tree', 'garden', 'food', 'forest', 'fruit'. Looking at the variables, this class aggregates particularly the discourse brought by members who do not express their willingness to aid others users for free, as they do not label themselves as Aid Worker and to a lesser extent by females, formally trained users, and Permaculture Research Institute teachers. Combining these terms with the studied variables, it looks like those members not explicitly willing to aid others for free focus on technical gardening aspects of Permaculture rather than the community building aspects of Permaculture.

The third class links together studying and working related terms: 'degree', 'university', 'study', 'work', 'project'. Looking at the studied variables, this class is contributed by members in particular who do not declare their gender online. Combining these terms with the studied variables, we advance that members who do not wish to disclose their gender prefer to put up front their degrees, education, diplomas, works, projects etc., as a wish to be recognized for their activities and studies rather than being trapped in gender stereotypes.

The fourth class links together skill terms: 'learn', 'develop', 'design', 'practical'. Looking at the variables, this class is contributed particularly by male users, teachers, aid workers and to a lesser

extent by people not formally trained. Combining these terms with the studied variables, we interpret that the male teachers and the male aid workers particularly express, in their discourses, the impact of developed individual skills and practices for themselves and for their communities, as a sort of preference for achievement, which is considered one of several masculinity traits (Hofstede 1998).

The fifth class links together personal life terms: 'person', 'live', 'life', 'me'. Looking at the variables, this class is contributed particularly by males looking for partner, females looking for partner, females more in general, and formally trained people. Combining these terms with the studied variables, first of all, we deduce that, independently of their gender, the members looking for a partner give a big space in their discourses to the personal aspects of their life and to their sentiments, a discourse associated with the femininity aspect of caring about the quality of life (Hofstede 1998).

The hyperlink network

The results about the hyperlink network open a space for discussion, first of all, about implications of the power law distribution concerning UGC. As a preliminary, we conclude that there is no such thing as an average member in the Permaculture social network. Indeed, the content production is not normally distributed: the majority of users contribute few items, whereas few users contribute a lot. This content generation pattern is similar to those reported for other online social networks (Ochoa and Duval 2008; Shriver *et al.* 2013). Hence, the content contribution on permacultureglobal.org follows the so-called participation inequality or '90-9-1' principle.

With regard to the codetermination of UGC and social ties, we find that the common pattern, found in other networks, such as Facebook (Saez-Trumper *et al.* 2011), or Soulrider.com (Shriver *et al.* 2013), is also present for permacultureglobal.org. Hence, permacultureglobal.org is subject to network effects in content generation: increasing the user's social ties on the network induces the user to post more content, which then results in this user obtaining more ties, which in turn causes the same user to post more content, and so on (Shriver *et al.* 2013). The large audience of the founder of the permaculture social network is evidently a standing recognition of his authority and special status in the network (Ackland & O'Neil, 2011). This leadership emerged spontaneously in the network by the aggregation of individual behaviors (DeRue *et al.* 2015).

With regard to the codetermination of geographical location and social ties, the empirical distribution is consistent with Zipf's Law (Zipf 2012), according to which density is proportional to the inverse of the distance. This result does not diverge from the results about other social networks

and electronic communications (Goldenberg and Levy 2009). Against the adage of a borderless society, our empirical findings show that even though physical distance is technically irrelevant for electronic communications, permacultureglobal.org users establish ties primarily with geographically close peers. Indeed this social network reaffirms that most of our social contacts remain local (Goldenberg & Levy, 2009). A specific reason for this geographical proximity in the permaculture social ties could be justified by the specific interest for a user in follow members in the same climatic region, hence, in general, geographically close, in order to be able to apply the agricultural information posted by the followed users in the following user's natural environment.

With regard to sparsity and clustering, our results show that permacultureglobal.org has a degree distribution and a clustering coefficient distribution which follow the power laws (Barabási and Albert 1999) which are found in other social network contexts (Clauset *et al.* 2009; Leskovec and Horvitz 2008; Myers *et al.* 2014). We wonder if the members outside of the main component, or more generally at the periphery of the hyperlink network feel the same 'we-ness' (Ackland & O'Neil, 2011) to Permaculture movement as the more central members. As far as this 'we-ness' is considered central to the definition of the collective identity, we question the possibilities for including them more in the network in order to strengthen the development and resilience of the permaculture social movement.

Overall discussion

The combination of the hyperlink network and semantic network discussions reached three general considerations, calling into question the extent to which the semantic network influences the hyperlink network. Our conclusions are that the specificities of the semantic network of permacultureglobal.org do not radically diverge the hyperlink network from the usual shape of online social networks found in other studies (Clauset *et al.* 2009; Goldenberg and Levy 2009; Jure *et al.* 2007; Myers *et al.* 2014; Shriver *et al.* 2013). On the one hand, this result shows that on the semantic networks the structural features of the hyperlink networks are independent of the content of the same network. Hence, the specificities of the Permaculture movement in terms of its semantic framework have no evident impact on the structure of the network of the movement. On other hand, we can advance that the key factors behind the success of social networks could be applicable to the Permaculture social network, too. One-structure-fits-all hence seems valid in the context of online social networks. Whatever the identity or the content of the network, the structural characteristics are largely invariant: the structure of the network always reproduces the same distribution of UGC, the same codetermination of UGC and social ties, the same codetermination of geographical location and social ties and the same sparsity and the same clustering of users.

In addition, we realize that the size and growth of the permacultureglobal.org, in terms of members, UGC, social ties, etc., shows an additional concrete case of the prominent role of Internet in facilitating communication, coordination and development of the social movements (Ackland and O'Neil 2011; Conover *et al.* 2013; Laer and Aelst 2010).

Finally, our analysis confirms that the Permaculture movement is a social movement (Ferguson and Lovell 2013) to the extent that its online manifestation, at the permacultureglobal.org website, takes the form of a network of informal interactions between a plurality of individuals engaged in several heterogeneous projects, - some of them cultural, political and conflicting - on the basis of a shared collective identity, which aggregates around the declination of Permaculture in agriculture and in other domains.

Conclusions

This study explored the Permaculture social movement for its relevance in the sustainable degrowth puzzle. We answered our research questions: What is the semantic network of the Permaculture movement? What is the hyperlink network of the Permaculture movement? We realize that the specificities of the semantic network do not impact the pattern of the hyperlink network sufficiently to make the hyperlink network significantly different from the pattern of the other online social networks. One-structure-fits-all hence seems valid in the context of online social networks. Whatever the identity or the content of the network, the structural characteristics are largely invariant. We could even speculate that the general structure of networks will remain valid also for the other radical 'exit from the economy' alternatives (Kallis, 2011) and degrowth Nowtopia (Carlsson & Manning, 2010) networks.

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Variable	Modality	Chi-square	Number of ECU in the class	Total number of ECU	%	P-value
Table 1 The modalities of the variables associated with each class						
Class 1: PDC						
Consultant	*Yes*	54.01	2,867	13,333	21.50	<0.001
Formal trained	No	122.07	3,382	15,441	21.90	<0.001
Official teacher	*Yes*	34.05	1,504	6,767	22.23	<0.001
Class 2: plant						
Aid worker	No	57.25	2,137	11,234	19.02	<0.001
Gender	*Female*	7.11	1,149	6,325	18.17	0.008
Male looking for partner	No	31.66	3,806	21,807	17.45	<0.001
Formal trained	*Yes*	53.40	1,544	7,873	19.61	<0.001
Official teacher	*No*	10.96	2,914	16,547	17.61	<0.001
PRI Official teacher	*Yes*	20.85	385	1,839	20.94	<0.001
Class 3: university						
Aid worker	*Yes*	22.55	2,342	12,080	19.39	<0.001
Consultant	Yes	87.26	2,703	13,333	20.27	<0.001
Gender	**Undeclared**	25.92	943	4,522	20.85	<0.001
Formal trained	*No*	22.15	2,946	15,441	19.08	<0.001
Official teacher	*Yes*	3.84	1,286	6,767	19.00	0.05
PRI Official teacher	No	51.68	4,029	21,475	18.76	<0.001
Class 4: human						
Aid worker	Yes	29.43	2,537	12,080	21.00	<0.001
Female looking for partner	**No**	10.47	4,496	22,736	19.77	0.001
Gender	**Male**	64.72	2,692	12,467	21.59	<0.001
Male looking for partner	*No*	2.37	4,306	21,807	19.75	0.12
Formal trained	*No*	31.61	3,194	15,441	20.69	<0.001
Official teacher	Yes	67.33	1,555	6,767	22.98	<0.001
PRI Official teacher	Yes	140.50	555	1,839	30.18	<0.001
Class 5: me						
Aid worker	*No*	7.56	2,922	11,234	26.01	0.005
Consultant	**No**	254.07	3,038	9,981	30.44	<0.001
Female looking for partner	**Yes**	11.76	181	578	31.31	<0.001
Gender	Female	21.02	1,729	6,325	27.34	<0.001
Male looking for partner	**Yes**	36.33	478	1,507	31.72	<0.001
Formal trained	Yes	172.74	2,396	7,873	30.43	<0.001
Official teacher	No	137.84	4,523	16,547	27.33	<0.001
PRI Official teacher	*No*	51.65	5,540	21,475	25.80	<0.001

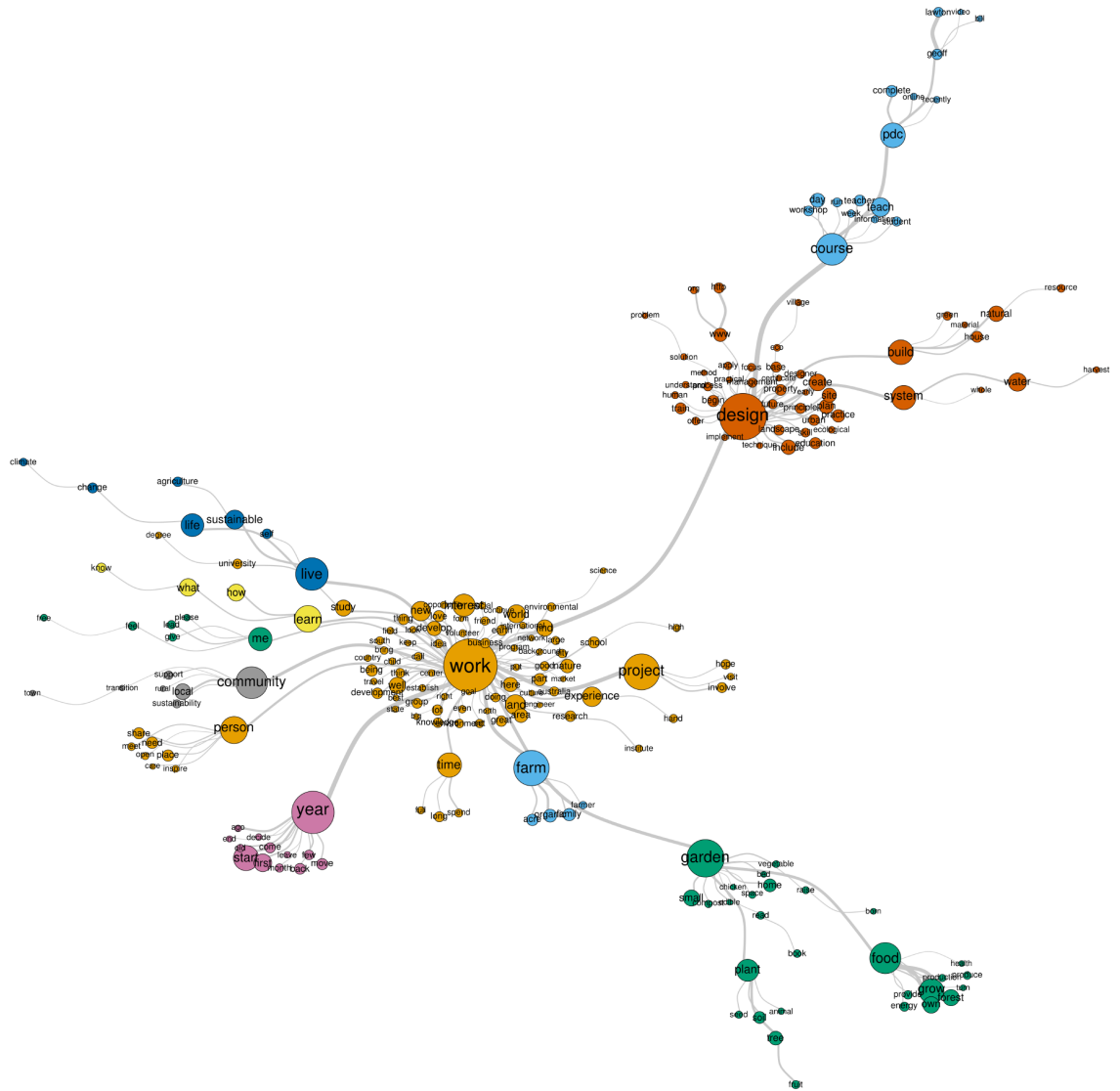Table 1 The modalities of the variables associated with each class

Figure 1 Graph of similarities applied to the autobiographic corpus, with relationships with a Chi-square of association over 40 and occurrences with frequency equal or higher than 400. The Graph presentation follows the Fruchterman Reingold rules. Colors highlight the communities among the terms based on the Betweenness index. Size of nodes and size of fonts are proportional to their frequency of occurrence. Thickness of relationships is proportional to the strength of the relationship based on the Chi-square index.
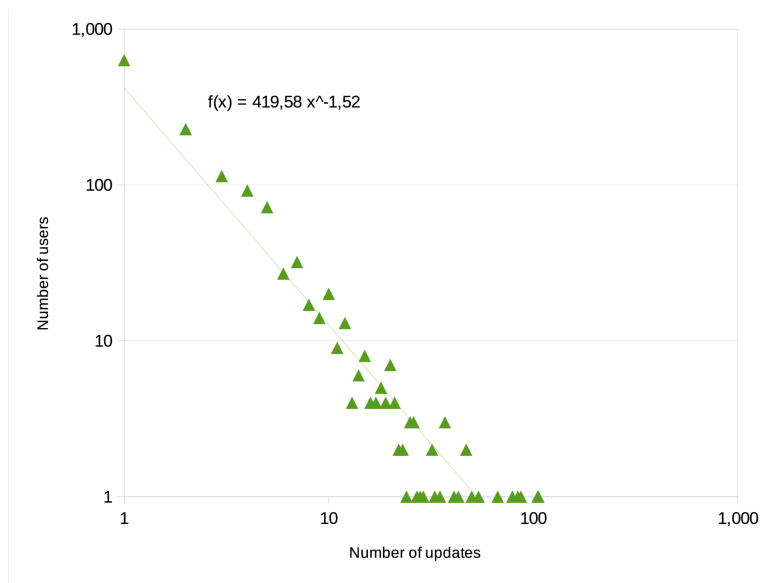
Figure 2: Log-Log Size-Frequency Plot, with an inverse linear relation between number of updates and number of users with that yield.