



Basic Psychological Need Satisfaction, Job Crafting, and Meaningful Work: Network Analysis

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Abstract

To satisfy the psychological needs at work, employees engage in job crafting, which allows them to modify their jobs in meaningful ways. This study extends the research by examining the relationships between variables of job crafting model (i.e., basic psychological need for autonomy, competence and relatedness, perceived opportunities to craft, job crafting, and meaningful work) in a single system network. Participants were 340 Brazilian professionals (mean age 46 years, 61% female). We used network analysis (e.g., partial correlations, shortest paths, centrality measures). The results indicated that psychological needs influenced behavioral crafting and that cognitive crafting served as a mediator of these strategies to meaningful work. Autonomy and perceived opportunities to craft were the shortest paths to meaningful work. Cognitive crafting exerted the strongest influence on meaningful work. The findings suggest that meaningful work is developed through a proactive bottom-up process.

Keywords Job crafting · Meaningful work · Perceived opportunity to craft · Basic psychological needs · Network analysis

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Introduction

Currently, work is an important life domain from which people derive meaningfulness to their lives (Steger et al., 2012). Professionals are looking for job opportunities to flourish, which lead them to switch jobs with more frequency than in previous generations. Talent retention became a strategic issue for organizations; however, one reason that may impel professionals to search for new job opportunities is because they are not finding positive meaning in their current roles. An alternative to switch jobs is staying in the same role and crafting one's own job to make it more fulfilling and meaningful (Wrzesniewski et al., 2013). This strategy, which fosters talent retention, work engagement, and well-being, is referred to in the literature as job crafting (Tims et al., 2012; Wrzesniewski & Dutton, 2001).

Job crafting is the process of employees redefining and recreating their job designs in personally meaningful ways (Wrzesniewski & Dutton, 2001). Job crafting encompasses daily proactive behavior that employees use when they feel that changes in their job are necessary (Petrou et al., 2012), and to ensure that congruence between individual needs and personal resources and their work environment (e.g., job demands and job resources) is being met or optimized (Tims et al., 2012).

Employees make small changes to their work environment on a daily basis to fulfill their intrinsic needs for autonomy (sense of volition), competence (sense of efficacy), and relatedness (sense of belonging) (Bakker & Oerlemans, 2019). Wrzesniewski & Dutton (2001) proposed that to satisfy psychological needs at work, employees make changes in job tasks or relationships in ways that allow them to reframe the purpose of their job and experience work as meaningful. The more job crafting opportunities employees perceive in their work environment, the more changes they will carry on tasks and relational boundaries at work (Wrzesniewski & Dutton, 2001).

Previous studies in positive organizational psychology investigated separately the relationships of job crafting with basic psychological needs (Bakker & Oerlemans, 2019; Slemp & Vella-Brodrick, 2014), perceived opportunities to craft a job (van Wingerden & Poell, 2017), and meaningful work (Tims et al., 2016; Vermooten et al., 2019) by means of analytical techniques (e.g., regression models, factor analysis, structural equation models). These techniques separate research findings on sub-pathways and can be less suited for examining the whole psychological system of interconnected variables and the roles played by specific variables (Simonet & Castille, 2020).

In this paper, we explore the relationships of basic psychological need for autonomy, competence and relatedness, perceived opportunities to craft a job, job crafting, and meaningful work. We used the seminal job crafting model (Wrzesniewski & Dutton, 2001) as a theoretical model to frame our study and the basic psychological need theory (BPNT; Vansteenkiste et al., 2020) to integrate the motivation to craft a job with basic psychological need satisfaction (BPNS). To explore the overall structural organization of these relationships and address its complexity (Barabási, 2011), we adopted the network perspective (Epskamp et al., 2012). Network research has gained more attention in the psychological sciences because psychological behavior

is conceptualized as a complex interplay of psychological and other components (Epskamp et al., 2018).

The Job Crafting Model

Job crafting was originally defined as “the physical and cognitive changes individuals make in the tasks or relational boundaries of their work” (Wrzesniewski & Dutton, 2001, p.179). Accordingly, job crafting encompasses three types of strategies: (a) task crafting (e.g., actual alterations to the number or scope of tasks), (b) cognitive crafting (e.g., reframing the meaning of work), and (c) relational crafting (e.g., changes in the quantity and quality of workplace relationships) (Wrzesniewski & Dutton, 2001). Task and relational crafting produce actual changes in job characteristics and in the social work environment, whereas cognitive crafting relates to intangible (mental) changes in perceptions of meaning at work (Lichtenthaler & Fischbach, 2016).

Wrzesniewski & Dutton (2001) argued that the motivation for job crafting arises from three individual needs: the need for maintaining control over certain aspects of the work, the need to create a positive self-image at work, and the need for connection with others in the workplace. Not all employees will try to fulfill these needs at work; however, more proactive employees will look for opportunities to craft their jobs to meet their psychological needs. The motivation to craft jobs and the perceived opportunities to craft affect the form and extent of job crafting (Wrzesniewski & Dutton, 2001).

The three forms of job crafting (i.e., task crafting, relational crafting, and cognitive crafting) produce specific effects (i.e., changes in job design and changes in the social work environment) and create alterations in the meaning of work (Wrzesniewski & Dutton, 2001). These alterations are not static. The meaning of work forged by job crafting can motivate employees to engage in additional job crafting by boosting their basic psychological needs.

The job crafting model postulates that all employees are potential job crafters; in all jobs, even those high in control and supervision, employees can use their freedom and creativity and play an active role in creating the meaning of their work. Thus, proactive employees recognize opportunities to satisfy their psychological needs, take personal initiative, and persevere to make meaningful changes in their work environment (Wrzesniewski et al., 2013).

Basic Psychological Need Satisfaction (BPNS) and Job Crafting

Employees can proactively look for opportunities to satisfy their individual needs at work rather than wait for the environment to provide it for them (Wrzesniewski & Dutton, 2001). Slemp & Vella-Brodrick (2014) proposed that the motivation to engage in job crafting aligns closely with the three psychological needs for autonomy, competence, and relatedness, defined by the basic psychological need theory (BPNT; Vansteenkiste et al., 2020).

Experiences of autonomy, competence, and relatedness satisfaction are essential for psychological growth, integrity, and wellness in all domains of life (Deci & Ryan, 2000). On the other hand, need dissatisfaction (i.e., subjective experiences of low satisfaction of autonomy, competence, and relatedness) positively predicted diminished well-being (Vansteenkiste et al., 2020). Specifically, in the work context, autonomy refers to the feeling of being in control of one's work environment and feeling that one causes, identifies with, and endorses one's own work behavior. Competence refers to one's feeling of being effective, skillful, and able to master the challenges at work. Relatedness refers to a sense of being connected to important others at work and a feeling of having caring relationships and belonging to a community. Workplaces can either support or thwart needs for autonomy, competence, and relatedness; when satisfied, these needs promote autonomous motivation, wellness, and effective performance (Deci et al., 2017).

Research in self-determination theory at work organizations also showed that the provision of environmental job resources (e.g., perceptions of their managers' autonomy support) satisfied employees' basic needs for autonomy, relatedness, and competence (Baard et al., 2004), whereas frustration of the psychological needs fostered job strain and impaired performance (Gagné & Vansteenkiste, 2013).

Furthermore, employees can proactively craft their own jobs to satisfy their basic psychological needs. According to the needs-as-motive perspective (Sheldon & Gunz, 2009), the three psychological needs (i.e., autonomy, competence, and relatedness) can function as orienting motives and have a motivational force when unsatisfied. Evidence showed that felt deficits in any of the three needs created a desire for experiences that would specifically satisfy the unmet need. Slemp & Vella-Brodrick (2014) found that job crafting predicted BPNS at work, which in turn predicted well-being. Van Wingerden et al. (2017) found that BPNS increased through an intervention that stimulated job crafting behavior and that the effect of both improved indices of work engagement. A diary research study showed evidence that on the days employees used job crafting strategies to increase social job resources (i.e., asked for social support and feedback) or craft structural job resources (i.e., sought opportunities for growth), they satisfied their basic psychological needs and increased their daily work engagement (Bakker & Oerlemans, 2019).

Based on that, we suggest that the levels of autonomy, competence, and relatedness need satisfaction will exert influence on job crafting. When employees feel low satisfaction of these needs within their current job designs, they likely will look for opportunities to craft their jobs in ways that allow them to meet their basic psychological needs. For example, employees who need to experience more autonomy at work will engage in task crafting (i.e., become involved in new projects and add more task variety) and relational crafting (i.e., build new interactions with internal clients). Employees looking for more relatedness will probably engage in relational crafting (i.e., organize or attend work-related social functions, make an effort to get to know people well at work) or even task crafting (i.e., help coworkers accomplish tasks). Employees in need of experience competence will engage in task crafting (i.e., learning new skills) or relational crafting (i.e., coaching new employees). Moreover, when employees engage in a process to fulfill any of these three needs, they may engage in cognitive crafting to change their views about their own job (i.e., remind oneself of the importance of one's work for the broader community, remind

oneself about the significance one's work has for the success of the organization). Thus, we expect that the need to satisfy the three psychological needs of autonomy, competence, and relatedness will relate to different job crafting strategies.

Meaningful Work, BPNS, and Job Crafting

Employees want to have not only decent work but also attain positive meaning from their jobs (Steger et al., 2012). More organizations recognize that fostering meaningful work is fundamental for engaging and retaining their employees. Recently, meaningful work has also gained more attention as an important psychological state on its own (Martela & Riekk, 2018; Wrzesniewski et al., 2013).

Meaningful work refers to work experienced "as particularly significant and holding more positive meaning for individuals" (Rosso et al., 2010, p.95). As an evaluative construct, it refers to an overall subjective evaluation of work regarding whether it is intrinsically valuable, personally significant, and worth doing (Lysova et al., 2019; Martela & Riekk, 2018). According to Steger et al. (2012), meaningful work is a eudaimonic experience oriented towards growth and purpose instead of hedonic (focused on pleasure). Meaningful work is something individuals achieve for themselves; it is self-constructed and not given or imposed by organizations (Tims et al., 2016).

Martela & Riekk (2018) found that the basic psychological needs of autonomy, competence, and relatedness were significantly and independently associated with meaningful work among employees of different occupational levels and organizations across cultures (i.e., Finland, USA, and India) and explained (together with the prosocial need of beneficence) 61% of the total variance in people's experience of meaningful work. This means that psychological need satisfaction seemed to be relevant in all organizations, occupational positions, and cultures and can serve as an important source of meaningful work. In line with the above, we expect that BPNS will relate with meaningful work.

Job crafting is an important pathway to meaningfulness in modern work contexts because employees take the initiative to make changes in their jobs that fulfill their psychological needs, contributing to their experiences of meaningful work (Wrzesniewski et al., 2013). Lysova et al. (2019) suggested that to enable individuals to move beyond satisfying their basic psychological needs by constructing their own sense of meaningful work, organizations should build and maintain work environments characterized by opportunities for job crafting. Tims et al. (2016) found that employees who crafted their job demands and increased job resources proactively optimized their person–job fit and, as a consequence, experienced their work as meaningful. Another study with financial services industry employees found evidence that job crafting (i.e., increasing social or structural job resources and challenging job demands and decreasing hindering job demands) had a significant positive influence on meaningful work (Vermooten et al., 2019).

Particularly important to meaningful work is the role played by cognitive crafting. Cognitive crafting was proposed as the facet of crafting that aligns most closely to meaning and identity at work because by reframing their views of their jobs,

employees can attain meaning from work, even without a behavioral change (Berg et al., 2013; Wrzesniewski & Dutton, 2001). However, cognitive crafting is a dimension that has been little examined in the job crafting literature (Buonocore et al., 2020; Zhang & Parker, 2019). Buonocore et al. (2020) demonstrated that cognitive crafting was an individual strategy to deal with moderate levels of job insecurity and with low and high levels of perceived external prestige. Cognitive crafting also predicted meaning and competence, whereas task crafting did not, which suggested that cognitive reframing can be more effective and relevant to deal with more ambiguous job demands, threats, or challenges (Hornung, 2019). Geldenhuys et al. (2020) found evidence that cognitive crafting indirectly influenced both peer-rated in-role and extra-role performance through meaningfulness and proposed that cognitive crafting was an important individual strategy in achieving meaningfulness at work. Thus, we expect that job crafting strategies will relate positively to meaningful work and that cognitive crafting will emerge as the main strategy to meaningful work.

Perceived Opportunities to Craft

Perceived opportunities to craft (POC) refers to a sense of freedom or discretion employees have in the job content and in how they perform it; thus, POC influences the relationship between an individual's motivation to craft and job crafting behaviors (Wrzesniewski & Dutton, 2001). Employees who wish to fulfill autonomy, competence, and relatedness needs at work will consider opportunities to change aspects of their job before crafting their jobs. For instance, an employee who experiences deficits in competence need will look for opportunities to craft his job to feel more competent at work. However, if he perceives low opportunities to change aspects of his job based on work conditions (i.e., high supervision control, lack of challenges), he will feel restricted to engage in job crafting. Otherwise, an employee who perceives opportunities to exert competence at work (i.e., opportunities to train new coworkers) will be more stimulated to change his job to meet his need for competence.

Recently, POC was operationalized in a scale that measures employees' perceptions regarding their opportunities to proactively optimize their work environment (van Wingerden and Niks, 2017). POC showed significant positive and moderate correlations with job crafting, occupational self-efficacy, work engagement, and negative associations with workaholism (Pimenta de Devotto et al., 2020). Thus, POC reflects an overall perception of the extent to which employees can proactively influence their jobs and work environments. In line with this, we expect that in the emergent network, POC will connect BPNS and job crafting strategies.

Therefore, in this study, we explore the interplay of the BPNS (autonomy, competence, and relatedness), POC, job crafting, and meaningful work. To our knowledge, these constructs have not been completely explored in a sole system network. We contribute to job crafting literature with an inductive study that aims to show meaningful work as an emergent phenomenon from a system of

reciprocal interactions with personal, contextual, and behavioral correlates. We also answer to the call for more exploratory papers to help restore the balance among deductive, abductive, and inductive approaches in organizational sciences and related disciplines (Spector, 2017; Woo et al., 2017). Central to our contribution is the use of network analysis for exploring the structure and associations between variables in a manner that is not allowed by deductive techniques (e.g., regression models, structural equation models) previous research relied on. In line with this, we set three research questions to guide our study: how participants' autonomy, competence, and relatedness associate with different job crafting strategies and meaningful work? How will participants' job crafting strategies relate to their perceptions of meaningful work? How do POC associate with BPNS and job crafting strategies?

Method

Participants

Participants were 340 professionals from different Brazilian states, 61% female, aged between 18 and 81 ($M=46$ years of age, $SD=15$ years of age). Data collection occurred from November 2019 to June 2020. It is important to note that 61.5% answered the instruments before March 2020, when compulsory remote work and social isolation measures were adopted nationally as strategies to reduce the COVID-19 pandemic. Thus, 38.5% of our sample, who answered the questionnaire between April and June of 2020, were working under the obligatory conditions of remote work. The data analyzed for this study come from a convenience sample. It was observed that 59% of participants held a postgraduate degree, 31% had completed higher education, and 10% had completed high school. Most participants were employed in private companies (57.6%), 22.9% were self-employed, 11% were public employees, 4.7% were voluntary workers, and 4.1% were trainees. The job tenure of the participants ranged from 1 year to over 10 years of experience; 41% of the sample worked over 10 years in the same organization, 18% worked between 5 and 10 years, 21% worked between 2 years and 5, and 20% worked less than 2 years. The majority of the sample worked in the service sector (86%), 13% worked in the industrial sector, and 1% in the agriculture sector. It was observed that 58% of participants lived in the southeast region of Brazil, 37% in the midwest region, 3% in the south region, and 3% in the northeast region.

Data Collection and Ethical Procedures

The participants were recruited using a convenience sampling technique. Various sources, such as social and professional media networks (e.g., LinkedIn) and the HR department of a higher education institution, were used to divulgate the study. The inclusion criteria for the participants were job tenure of more than 6 months and age older than 18 years. The respondents were invited to participate on a voluntary basis.

Those individuals who agreed to participate answered the instruments after agreeing with the informed consent form (*online* data collection). This study received approval from the Ethics Committee of the Pontifical Catholic University of Campinas, with CAEE 23247919.4.0000.548.

Measures

Sociodemographic Questionnaire The instrument identifies the study sample in relation to demographic variables relevant to the research (e.g., gender, age, educational level, job tenure).

Balanced Measure of Psychological Need Scale (BMPN, Sheldon & Hilper, 2012, Adapted by Vicentini, 2018) The BMPN assesses the perception of the satisfaction of the three basic psychological needs: autonomy, competence, and relatedness. Participants responded to the 18 items on a Likert-type scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*). The original scale presented adequate evidence of validity (CFI=0.97, SRMR=0.04, RMSEA (90% CI)=0.040 (0.03–0.05) (Sheldon & Hilpert, 2012). The adaptation study of the BMPN to Brazil yielded reliable indices (autonomy, $a=0.95$; competence, $a=0.95$; and relatedness, $a=0.92$) (Vicentini, 2018). In the present sample, the fit indices were satisfactory ($\chi^2(df)=(113) 222.6, p<0.001$, CFI=0.95 TLI=0.93 RMSEA (90% CI)=0.05 (0.04–0.06)). Reliability for this sample was adequate in the three subscales (autonomy, $a=0.60, w=0.86$; competence, $a=0.61, w=0.86$; and relatedness, $a=0.60, w=0.95$).

Perceived Opportunity to Craft Scale (POCS, van Wingerden & Niks, 2017, Adapted by Pimenta de Devotto et al., 2020) The scale consists of five items answered on a 5-point Likert scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The instrument showed adequate evidence of validity in the adaptation study of the POCS to the Brazilian context ($\chi^2(df)=(5) 12.4, p<0.001$, CFI=0.98, TLI=0.96, RMSEA (90% CI)=0.64 (0.02–0.11), $a=0.78$) (Pimenta de Devotto et al., 2020). In the present sample, the fit indices ($\chi^2(df)=(5) 25.6, p<0.001$, CFI=0.98, TLI=0.96, RMSEA (90% CI)=0.11 (0.07–0.15)) and the reliability ($a=0.78, w=0.81$) of the POCS were satisfactory.

Job Crafting Questionnaire (JCQ, Slemp & Vella-Brodrick, 2013, Adapted by Pimenta de Devotto & Machado, 2020) This 15-item scale consists of three subscales: task crafting, relational crafting, and cognitive crafting, answered on a 5-point Likert scale ranging from 1 (*rarely*) to 5 (*very often*). The evidence of validity of the questionnaire ($c^2(df)=(87) 149.0, p<0.001$, CFI=0.96, RMSEA=0.06) and reliability (task crafting, $\alpha=0.87$; cognitive crafting, $\alpha=0.89$; relational crafting, $\alpha=0.83$) to assess the three dimensions of job crafting was adequate in the scale development study (Slemp & Vella-Brodrick, 2013). The adaptation of JCQ in the Brazilian context presented satisfactory composite reliability (cr) indices (task crafting, $cr=0.80$;

cognitive crafting, $cr=0.93$; and relational crafting, $cr=0.75$) and great goodness of fit indices ($c^2(df)=(87)$ 108.5, $p > 0.001$, TLI=0.93, RMSEA (90% CI)=0.04 (0.00–0.06)) (Pimenta de Devotto & Machado, 2020). The reliability of the subscales (task crafting, $a=0.82$, $w=0.81$; cognitive crafting, $a=0.88$, $w=0.87$; and relational crafting, $a=0.77$, $w=0.74$) and fit indices ($c^2(df)=(87)$ 304.7, $p < 0.001$, CFI=0.95, TLI=0.93, RMSEA (90% CI)=0.09 (0.08–0.10)) of the Job Crafting Questionnaire were satisfactory in the present sample.

Work and Meaning Inventory (WAMI, Steger et al., 2012, Adapted by Leonardo et al., 2019) This is a 10-item measure scored on a 5-point Likert scale ranging from 1 (*absolutely untrue*) to 5 (*absolutely true*). The study of the development of WAMI showed that the scale had adequate fit indices (CFI=0.98, RMSEA=0.09) (Steger et al., 2012). The Brazilian version of WAMI had better adjustment indices in the unifactorial structure (TLI=0.99, RMSEA=0.08) (Leonardo et al., 2019). In the present sample, the fit indices ($c^2(df)=(35)$ 258.7, $p < 0.001$, CFI=0.96, TLI=0.95, RMSEA (90% CI)=0.14 (0.12–0.15)) and reliability ($a=0.88$, $w=0.90$) of WAMI were adequate.

Network analysis is an exploratory model based on regularized peer-to-peer interaction between all elements in a system (Epskamp et al., 2018). As an inductive method, network analysis does not limit the relationships between system elements and enables new patterns of relationships to emerge from empirical data.

The product of network analysis is a graphical model in which variables are represented by nodes (or circles) and the relationships between variables as edges (or lines). In the present study, positive correlations were represented by different tones of gray in a way that the darker and thicker edges correspond to stronger correlations. Nodes are positioned using the Fruchterman & Reingold (1991) spring algorithm in a way that the resulting graph visually represents the relative strength of node connections. Nodes placed closer together are more strongly connected, and nodes nearer the center of the graph have the strongest connections to other nodes (Epskamp et al., 2012).

To estimate the partial correlation network between the nodes, the graphical least absolute shrinkage and selection operator (GLASSO, Friedman et al., 2008) algorithm was applied. The partial correlation network allows the estimation of the association between nodes after controlling for the effects of all other nodes included in the system (Epskamp et al., 2018). An important advantage of the GLASSO method is that it forces small partial correlations to lessen to zero, making possible the analysis of a more parsimonious model. The final solution of the partial correlation network is selected considering the extended Bayesian information criterion (EBIC; Foygel & Drton, 2011) in such a way that the model with the lowest residual is chosen.

A network illustrating the shortest paths from each psychological need satisfaction (autonomy, competence, and relatedness), job crafting dimensions (task crafting, relational crafting, and cognitive crafting), and perceived opportunity to craft to meaningful work was computed. The network of the shortest paths of the association of these nodes was calculated to determine whether they have direct or mediated relationships in the model (Opsahl et al., 2010). The shortest path analysis highlights

the path that requires the minimum number of steps to go from point A to point B. The evaluation of the shortest paths in a partial correlation network allows us to identify which variables explain the established nodes as an outcome. The direct relation between a pair of nodes indicates that the two nodes predict each other. In addition, this analysis makes it possible to identify mediation relationships between variables, since the path from point A to point B can necessarily occur through point C, showing a mediation of C in the relationship between A and B (Simonet & Castille, 2020). In the shortest path graph, gray lines represent the shortest path to the outcome node, and the dotted lines indicate relations that are not relevant in this type of analysis.

The role of each variable in the network of partial correlations assessed was investigated through the estimation of the centrality measures (expected influence, closeness, and betweenness). Centrality indices provide insight into the relative importance of a node in the context of the other nodes in the network (Hevey, 2018). The accuracy and stability of the centrality indices of the network were estimated by evaluating 95% confidence intervals (CI) using bootstrapping samples ($n=2,500$) (Epskamp et al., 2018). The correlation stability coefficient (CS-coefficient; Epskamp et al., 2018) equal or greater than 0.7 shows that, even after excluding 70% of the original sample, centrality measures are stable enough to be interpreted.

Expected influence contributes to identifying nodes with higher influence on the activation of the network system. Its calculation does not consider the absolute value of edges before summing them. Closeness centrality refers to the proximity of a variable to the rest of the network's variables. Its calculation considers the inverse of the weighted sum of the shortest path from a given node to all other nodes (Hevey, 2018). Betweenness centrality comprehends the number of times that a variable is the shortest path in the relation between two variables (Simonet & Castille, 2020) and provides information on how important a node is in the average pathway between other pairs of nodes (Hevey, 2018). All analyses were performed in R Studio. The R package *qgraph* and *bootnet* were used to analyze and visualize the networks (Epskamp et al., 2018).

Results

The descriptive statistics (mean and standard deviation) of the scores of psychological need dimensions, job crafting strategies, POCs, and meaningful work are presented in Table 1. All scores ranged from 1 (minimum), which indicates low values of the phenomenon, to five (maximum), which suggests high values of the variable measured. It is important to note that the sample mean in all variables was higher than 2.5, suggesting that participants of this study showed high levels of the measured variables, especially task crafting, cognitive crafting, POC, and meaningful work.

The regularized partial correlation network is presented in Table 1, and the resulting parsimonious network visualization graph with the most relevant and stable associations of all variables within the system is displayed in Fig. 1. Notably,

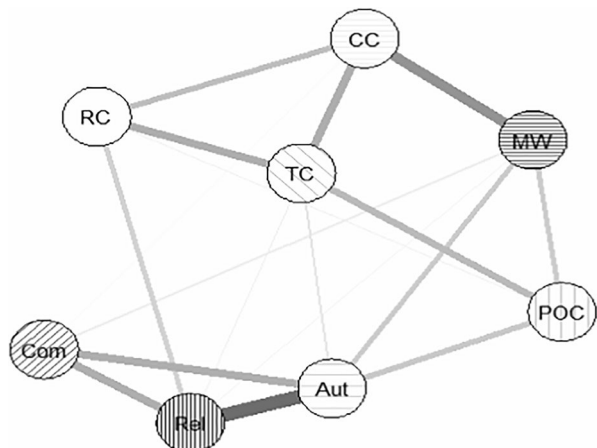
Table 1 Regularized partial correlation network and shortest path between BPNS dimensions, job crafting strategies, POCs, and meaningful work

	<i>M (SD)</i>	1	2	3	4	5	6	7	8
(1) Autonomy need satisfaction	3.4 (0.5)		1, 2	1, 3	1, 7, 4	1, 8, 5	1, 3, 6	1, 7	1, 8
(2) Competence need satisfaction	3.3 (0.5)	0.27		2, 3	2, 7, 4	2, 8, 5	2, 3, 6	2, 1, 7	2, 1, 8
(3) Relatedness need satisfaction	3.2 (0.5)	0.50	0.27		3, 6, 4	3, 1, 8, 5	3, 6	3, 1, 7	3, 1, 8
(4) Task crafting	4.1 (0.7)	0.07	0	0		4, 5	4, 6	4, 7	4, 5, 8
(5) Cognitive crafting	3.6 (0.8)	0	0.02	0.05	0.27		5, 6	5, 4, 7	5, 8
(6) Relational crafting	2.8 (0.7)	0	0	0.14	0.27	0.21		6, 4, 7	6, 5, 8
(7) Perceived opportunities to craft	3.8 (0.9)	0.18	0	0.01	0.23	0	0.05		7, 8
(8) Meaningful work	3.9 (0.6)	0.17	0.05	0.04	0	0.36	0	0.16	

The least absolute shrinkage and selection operator (GLASSO) does not produce traditional p -values but rather estimates all partial correlations while minimizing a penalty term based on the sum of the absolute values of the coefficients.

all variables in the network are positively related to at least three other variables, indicating the absence of negative associations within this network. The three basic psychological needs were related to each other and most proximate to each other. Autonomy need satisfaction and relatedness need satisfaction showed a moderate partial correlation ($r=0.50$). The three job crafting strategies were related and proximate to each other. Autonomy need satisfaction and task crafting are positioned more central in the network, which indicates that they are nodes with a higher number of associations. Contrary to what we expected, POC was positioned more peripherally in the network; however, POC functioned as one of the paths between job crafting and meaningful work and one important link between basic psychological needs and meaningful work.

Fig. 1 Graphical GLASSO network in which edge weights reflect the relative strength of an association. Aut = autonomy need satisfaction; Com = competence need satisfaction; Rel = relatedness need satisfaction; POC = perceived opportunities to craft; MW = meaningful work; TC = task crafting; CC = cognitive crafting; RC = relational crafting



There are some noteworthy associations. Contrary to what we expected, basic psychological needs were not strongly connected to job crafting strategies (Table 1 and Fig. 1). Autonomy need satisfaction was only connected to task crafting ($r=0.07$), and relatedness need satisfaction also showed a weak partial correlation with relational crafting ($r=0.14$). Weak partial correlations were also observed between competence need satisfaction and cognitive crafting ($r=0.02$) and between relatedness need satisfaction and cognitive crafting ($r=0.05$). Although sample means indicated that participants had high levels of BPNS, relatedness need satisfaction showed the lowest mean of the three psychological needs ($M=3.2$, $SD=0.5$). This higher felt deficit in relatedness need satisfaction may be indicative of the motivation to engage in more than one job crafting strategy to satisfy the unmet need (i.e., relational crafting and cognitive crafting).

We investigated the most relevant direct relationships of BPNS to meaningful work. Autonomy ($r=0.17$), competence ($r=0.05$), and relatedness ($r=0.04$) need satisfaction showed a direct association with meaningful work. As we expected, cognitive crafting held the strongest and most direct connection to meaningful work ($r=0.36$), while the other two job crafting strategies showed indirect connections to meaningful work.

The results also revealed the existence of some paths from BPNS to meaningful work through job crafting strategies (Table 1 and Fig. 1). The paths found included at least two types of job crafting strategies in a sequence of nodes influencing each other to reach meaningful work. Relatedness need satisfaction directly influenced relational crafting, which in turn influenced task crafting and cognitive crafting, to finally impact meaningful work. Autonomy and competence need satisfaction influenced POC, which in turn affected task crafting, and task crafting influenced meaningful work through cognitive crafting (Table 1). Cognitive crafting served as a mediator of two behavioral crafting strategies to meaningful work. Moreover, we expected that POC would be positively related to BPNS and job crafting strategies. POC connected autonomy need satisfaction and competence need satisfaction to task crafting (Table 1 and Fig. 1), which indicated that POC served as a mediator between autonomy and competence need satisfaction and task crafting.

Overall effects on network connectivity are partially reflected in the centrality indices. Expected influence centrality indices showed stability (Fig. 2a), suggesting that this centrality measure is relatively stable for interpretation (Epskamp et al., 2018). Centrality indices of closeness (Fig. 2b) and betweenness (Fig. 2c) did not present stability; thus, these results should not be generalized as evidence of the relations of BPNS, job crafting, and meaningful work in different samples.

The BPNS of autonomy and relatedness and cognitive crafting presented the highest expected influence (Fig. 3), which revealed their importance within the system and their role in promptly affecting other parts of the network. Although closeness and betweenness did not show stability (Fig. 2b and 2c), it is important to note that in this sample, autonomy need satisfaction was very high in closeness and betweenness (Fig. 3). This indicated that in present sample autonomy was a common bridge that connected the other psychological needs to POC and to meaningful work. Relatedness need satisfaction, cognitive crafting, and

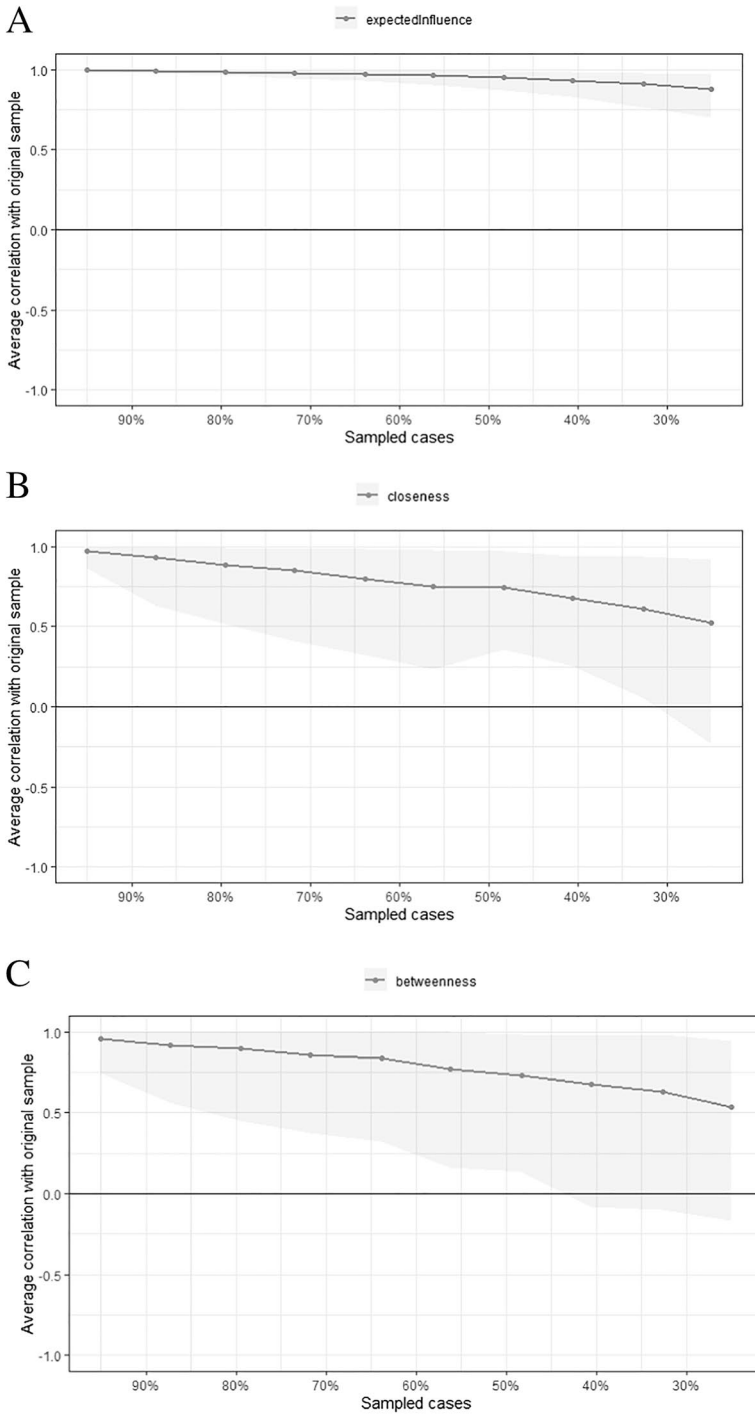


Fig. 2 Stability of centrality measures

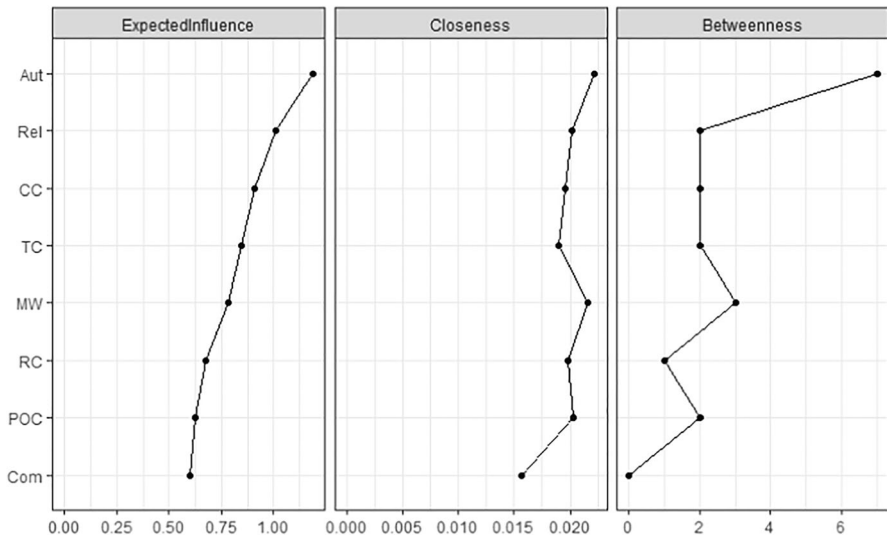


Fig. 3 Centrality plot. Aut=autonomy need satisfaction; Com=competence need satisfaction; Rel=relatedness need satisfaction; POC=perceived opportunities to craft; MW=meaningful work; TC=task crafting; CC=cognitive crafting; RC=relational crafting

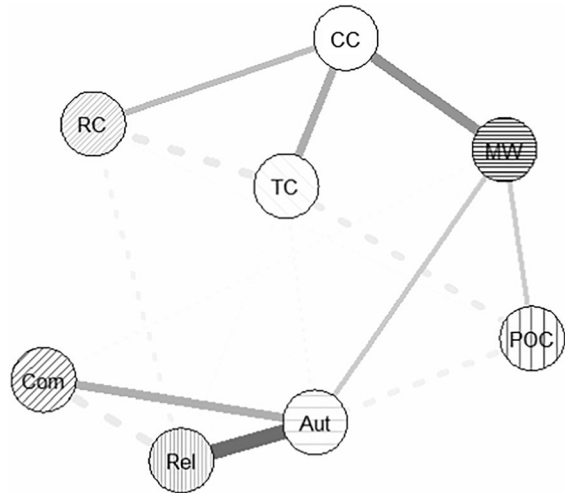
task crafting showed moderate closeness, which indicated that they produced changes in other parts of the network (Hevey, 2018).

The shortest path network illustrating the smallest distance between all nodes and meaningful work is presented in Fig. 4 and Table 1. The results showed three main shortest paths to meaningful work: cognitive crafting, autonomy need satisfaction, and POC. The shortest and strongest route to meaningful work was through cognitive crafting. Surprisingly, behavioral job crafting strategies (i.e., task crafting and relational crafting) were not linked to meaningful work. Their influence on meaningful work occurred via cognitive crafting in a way that cognitive crafting served as a mediator of behavioral crafting to affect meaningful work. In the same fashion, autonomy need satisfaction was the main path for the other two psychological needs to influence meaningful work. The shortest routes for all nodes to impact meaningful work were by their association with cognitive crafting and with autonomy need satisfaction. Surprisingly, the shortest paths analysis also revealed that POC had a direct effect on meaningful work (Table 1 and Fig. 4) and contributed to explaining meaningful work.

Discussion

Employees engage in job crafting strategies to make their job more meaningful and to satisfy their psychological needs at work (Berg et al., 2013; Wrzesniewski et al., 2013). Evidence has shown that employees engage in daily job crafting to satisfy their needs

Fig. 4 Networking depicts the shortest paths between psychological need satisfaction, perceived opportunities to craft, job crafting, and meaningful work. Edges < 0.01 are minimized for clarity. Aut = autonomy need satisfaction; Com = competence need satisfaction; Rel = relatedness need satisfaction; POC = perceived opportunities to craft; MW = meaningful work; TC = task crafting; CC = cognitive crafting; RC = relational crafting; dotted lines indicate relations that are not relevant in the shortest path analyzed



of autonomy, competence, and relatedness at work (Bakker & Oerlemans, 2019; Slemp & Vella-Brodrick, 2014) and that high levels of BPNS can determine how much meaningfulness people derive from work (Martela & Riekk, 2018). On the other hand, job crafting strategies exerted a significant positive influence on meaningful work (Tims et al., 2016; Vermooten et al., 2019). In this paper, we investigated the relationships of key variables of the job crafting model (Wrzesniewski & Dutton, 2001) in a single network adopting an exploratory perspective, which were observed in a sample of qualified professionals mainly working in the service sector in Brazil.

The resulting network encompasses only positive correlations. The positive associations between the variables are in line with evidence that showed that higher levels of job crafting positively influenced meaningful work (Tims et al., 2016; Vermooten et al., 2019), BPNS (Bakker & Oerlemans, 2019; van Wingerden et al., 2017), and POC (van Wingerden & Poell, 2017). Our findings also corroborate the positive correlations between meaningful work and BPNS (Martela & Riekk, 2018). Moreover, the solely positive relationships found in the network suggest the existence of reciprocal positive effects between the selected variables and may be indicative of a system with positive feedback loops. For example, the satisfaction of a need resulted in a positive behavior (i.e., relational crafting), which then influenced another positive attitude (i.e., cognitive crafting) that influenced a positive outcome (meaningful work).

The parsimonious graph indicated that the three job crafting strategies were placed closer to meaningful work compared to the distance of BPNS to meaningful work. This result suggests that the stronger path to find meaning at work was by means of crafting. Cognitive crafting had the strongest and closest relationship with meaningful work. Task crafting assumed a central position in the network, indicating that a behavioral crafting strategy was crucial for the functioning of the system. Actual changes in the number and scope of tasks were a way to satisfy the needs (i.e., autonomy) or a step to engage in other forms of crafting. This finding is in line with evidence that showed differential effects of job crafting

strategies. Task crafting predicted control-oriented empowerment dimensions of self-determination and impact (i.e., degree of authority and discretion in fulfilling job tasks, decisions on work goals, methods, and timing), and cognitive crafting affected the person-oriented dimension of meaning (Hornung, 2019).

We also highlight the role played by autonomy need satisfaction as the most influential psychological need in the system, considering the stability and accuracy of its expected influence. Autonomy emerged as a key mediator between the other two psychological needs and other variables and was one of the three shortest paths to meaningful work. This corroborates the idea that autonomy is an important source of meaningful work and that qualified professionals tend to emphasize autonomy need satisfaction compared to other psychological needs (Martela & Riekk, 2018). Job crafters need to feel that their actions emanate from the self and reflect their personal beliefs and passions instead of being the result of external pressures (Berg et al., 2013; Wrzesniewski et al., 2013).

Contrary to what we expected, we found some weak partial correlations between BPNS and job crafting strategies. We think that the lack of strong positive relationships between the BPNS and job crafting strategies can be mainly explained by two factors. First, sample means indicated that participants presented high levels of BPNS, which means that they had low deficits in autonomy, competence, and relatedness at work. According to the needs-as-motive perspective (Sheldon & Gunz, 2009), felt deficits in any of the three needs may create a desire for more job crafting that would specifically satisfy the unmet need. We suggest that the high levels of BPNS in our sample diminished participants' proactivity for job crafting. Second, the nodes represented in the network measured BPNS. We did not use a measure to assess dissatisfaction of needs, so we were not able to observe how basic need dissatisfaction influences job crafting.

We found direct positive associations between the three BPNS and meaningful work, corroborating previous research (Martela & Riekk, 2018). Our study computed a network of nondirectional edges because data were represented as bivariate partial correlations between the variables. Thus, we cannot assume that meaningful work is causing BPNS, because the direction of the effect was not calculated. Despite the lack of directionality of the relationships in the network analyzed, these findings showed that meaningful work may promote a positive surfeit of psychological need satisfaction, which arouses levels of motivation for more of the corresponding psychological "growth" needs (Sheldon & Gunz, 2009). Future studies can investigate whether meaningful work can influence a positive surfeit of BPNS, which in turn strengthens the motivation for more of a positive experience and encourages further job crafting actions.

The computed network also showed how meaningful work is associated to POC. We expected that POC will connect solely BPNS and job crafting; however, POC mediated the relationship of job crafting and meaningful work. We suggest that the perception of work being meaningful may be a condition to perceive opportunities to craft. Considering that job crafting requires an investment of personal resources, employees need to perceive their work as intrinsically valuable and worth doing (Lysova et al., 2019; Martela & Riekk, 2018) before perceiving opportunities to change it.

Regarding job crafting strategies, it is noteworthy that cognitive crafting plays a role in the sparse network. Cognitive crafting held the strongest connection to meaningful work and was the most relevant and shortest route to this outcome variable. Additionally, cognitive crafting mediated the influence of behavioral job crafting strategies (i.e., task crafting and relational crafting) on meaningful work. Cognitive crafting refers to changes employees make in the way they perceive tasks and relationships at work. Employees can cultivate meaningfulness by broadening their perceptions of the impact or purpose of their jobs, by focusing on specific tasks and relationships that are significant or valuable to them, by linking specific tasks or relationships with interests, or by focusing on aspects of their self that are meaningful to them (Berg et al., 2013). Our results offer support for the proposition that cognitive crafting is the crafting strategy that aligns most closely to meaningful work (Berg et al., 2013; Wrzesniewski & Dutton, 2001) and are in line with empirical data about the relevance of cognitive crafting for achieving meaningfulness at work (Geldenhuis et al., 2020; Hornung, 2019).

Wrzesniewski & Dutton (2001) proposed that job crafting has a mediating role in the relationship between basic psychological needs and meaningful work. In our sample, job crafting was not a mediator in the relationship of BPNS and meaningful work. However, we observed paths that suggest a process within the three types of job crafting strategies, where the effect of BPNS occurred on behavioral crafting (i.e., relational crafting and on task crafting) with or without the mediation of POC, to subsequently affect cognitive crafting and influence meaningful work. Nonetheless, the temporal sequencing of job crafting strategies cannot be tested with the present cross-sectional data set. This is an interesting route that warrants further examination using longitudinal methods and directed networks that can represent causal structures.

Our study yielded important information but had some limitations. We used a nonprobabilistic convenience sample. Sample characteristics and convenience sample type may limit the generalization of results to other types of research (Schiffman & Kanuk, 2007). Our sample was characterized by qualified professionals with a high level of education, which may limit the generalization of the results to other groups. For instance, the absence of stability in closeness and betweenness centrality measures may be associated to the sample demographics because participants were highly educated professionals. Additionally, 38% of participants responded to the survey during compulsory remote work and social isolation (April to June 2020), which may influence our results.

Our sample size was also a limitation for claiming the properties of the sparse network computed. The larger the sample size, the more stable and accurate networks are estimated (Hevey, 2018). Another limitation refers to the sole use of a measure of BPNS and the absence of a measure to specifically capture the dissatisfaction of psychological needs. To better understand the relationship of basic psychological needs and job crafting, future research should seek to separate the measurement of dissatisfaction and satisfaction of psychological needs. Although we adopted a measure of job crafting that assessed behavioral and cognitive crafting, we could not cover the full range of job crafting types. As research is becoming more focused on types of behavioral and cognitive forms of job crafting, future studies should explore

the different facets of approach and avoidance (cognitive and behavioral) crafting (Zhang & Parker, 2019).

The use of cross-sectional data and the application of a nondirected network limited our contribution to an exploratory study, where the set of complex relationships between psychological variables encompassed by the job crafting model (Wrzesniewski & Dutton, 2001) were analyzed in a single system network. We did not intend to produce a confirmatory study. The literature acknowledges the need to progress towards confirmatory network modeling wherein hypotheses about network structure are formally tested (Hevey, 2018). Future network analysis of the job crafting phenomenon can investigate the direction of the effects in the system and confirm causal inferences. Future studies should also investigate the effects of interventions that stimulate employees' job crafting behaviors, especially cognitive crafting.

In conclusion, the present study provides empirical evidence for the positive relationships between psychological needs for autonomy, competence and relatedness, POC, task crafting, cognitive crafting, relational crafting, and meaningful work. These connections were computed in a sparse network that revealed the relevant roles of autonomy need satisfaction, POC, and cognitive crafting as important paths to meaningful work. Our contribution highlights that meaningful work cannot be given or imposed top-down; rather, it requires employee autonomy to fulfill their psychological needs at work by engaging in behavioral and cognitive crafting to change the status quo.

Author Contribution RPD conceived the study, participated in its design, worked on the data collection, and wrote the manuscript. CPPF analyze the data and wrote the manuscript. SMW conceived the study, participated in its design, and reviewed the manuscript. All authors read and approved the final manuscript.

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Data Availability The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics The study was approved by the Committee for Ethics of Pontificia Universidade Católica de Campinas. All participants were properly informed of their rights. Informed consent forms were signed by those who agreed to participate.

Competing Interests The authors declare no competing interests.

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