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Symmetry in social exchange and health

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Symmetry is a relevant concept in sociological theories of exchange. It is rooted in the evolutionary old norm of social reciprocity and is particularly important in social contracts. Symmetry breaking through violation of the norm of reciprocity generates strain in micro-social systems and, above all, in victims of non-symmetric exchange. In this contribution, adverse health consequences of symmetry breaking in contractual social exchange are analysed, with a main focus on the employment contract. Scientific evidence is derived from prospective epidemiological studies testing the model of effort–reward imbalance at work. Overall, a twofold elevated risk of incident disease is observed in employed men and women who are exposed to non-symmetric exchange. Health risks include coronary heart disease, depression and alcohol dependence, among others. Preliminary results suggest similar effects on health produced by symmetry breaking in other types of social relationships (e.g. partnership, parental roles). These findings underline the importance of symmetry in contractual social exchange for health and well-being.

Introduction

Homo sapiens has evolved as a social animal. Species survival was contingent on coordinated collective action and on providing help to, and receiving help from other members. The norm of social reciprocity was established as a fundamental, evolutionary stable principle. According to this norm, any action or service provided by person A to person B that has some utility to B is expected to be returned by person B to A.[1] Exchange expectancy does not implicate full identity of the service in return, but it is essential that this activity meets some agreed-upon standard of equivalence. Symmetry of social exchange is characterized by

equivalence of return. Conversely, in asymmetric social exchange, service in turn is either denied or it fails to meet the agreed-upon level of equivalence.

To secure equivalence of return in crucial transactions, social contracts have been established as a universal societal institution. A contract defines a norm of equivalence by specifying obligations and benefits, rights and duties in interpersonal exchange. Trade, work and employment, marriage and intergenerational transfer are examples of contractual exchange. These contracts may vary considerably according to the specificity of their regulations, the sanctions expected in case of deviance, or the time frame of exchange. Yet, in all instances contracts are instrumental in providing members of a society with a sense of security by creating trust. Trust is a mental state motivating people to engage themselves in social exchange even if the trade-off is highly uncertain. Expectancy of symmetry of exchange is the driving force of trust.

The principle of reciprocity is not only rooted in human evolution, but plays a significant role in ontogenesis as well. Research on attachment formation in infancy has demonstrated the importance of reciprocal exchange between infant and caregiver in early postnatal life as one of the preconditions of normal human development.[2] For these reasons, breaking the symmetry of social exchange, and particularly of contractual exchange, by violating the norm of reciprocity is expected to have adverse consequences for a destabilized micro-social system and, above all, for persons who are becoming victims of failed reciprocity.

In order to understand the material and emotional costs of symmetry breaking, it is important to bear in mind the intimate links that exist between the opportunities created by contractual exchange and individual need fulfilment. This is best illustrated by the employment contract.

Importantly, having a job is a prerequisite for a regular income. Level of income determines a wide range of life chances. Achievement of occupational status through employment contract enables people to develop personal growth, skills and competencies and to build a social identity that transcends the primary groups of family and kinship. In addition, efforts and achievements that are reciprocated by adequate rewards in contractual exchange provide unique opportunities to experience recognition, success, self-esteem and satisfaction. Yet, when expectations are not met, when reciprocity fails or people are let down, intense negative emotions of anger, irritation and disappointment are elicited, and adverse social and material consequences may result from these threats to control and reward.

In this contribution, adverse health consequences of symmetry breaking in contractual social exchange are analysed, with a main focus on the employment contract. Additionally, less formalized types of contractual exchange are considered; in particular, marital or partnership relationship, exchange between parents and children, and non-specified social transactions that are experienced

as negative life events. The main hypothesis states that recurrent or long-lasting non-reciprocity in contractual exchange increases the risk of stress-related disorders in exposed people, due to the powerful role of this evolutionary old grammar of interpersonal cooperation.

Non-symmetric social exchange: theoretical approach

The principle of social reciprocity lies at the core of the employment contract, which defines distinct obligations or tasks to be performed in exchange with equitable rewards. Yet a theoretical approach, termed 'effort–reward imbalance' claims that non-symmetric contractual exchange is expected to occur frequently under specific conditions (see below). In this case, great efforts spent at work are not reciprocated by equitable rewards in terms of money, esteem and career opportunities, including job security.[3] The model of effort–reward imbalance claims that lack of reciprocity between the costs and gains (i.e. high-cost low-gain conditions) elicits strong negative emotions with special propensity to sustained autonomic and neuroendocrine activation and their adverse long-term consequences for health.

But why should people expose themselves to high-cost/low-gain conditions? According to the expectancy-value theory of human behaviour, the typical reaction to this situation is either a reduction of one's own investment (effort) or the search for an alternative, more favourable exchange. In other words, people tend to balance their efforts and rewards towards states of symmetry.[4] However, striving for symmetry in exchange may not be as universal as proposed by the expectancy-value theory. The theory of non-symmetric social exchange claims that there are at least three important conditions that operate against this principle: 'dependency', 'strategic choice' and 'overcommitment'.

'Dependency' reflects the structural constraints observed in certain types of employment contracts, especially so in unskilled or semi-skilled workers, in elderly employees, in employees with restricted mobility or limited work ability, and in workers with short-term contracts. In all these instances, incentives of paying non-equitable rewards are high for employers, while the risks of rejecting an unfair contractual transaction by employees are low. The reason of this asymmetric exchange is best described by one of the founders of economic theory, John Stuart Mill: 'The really exhausting and the really repulsive labours, instead of being better paid than others, are almost invariably paid the worst of all, because performed by those who have no choice. The inequalities of wages are generally in an opposite direction to the equitable principle of compensation' (Ref. 5, p. 383). Non-symmetric contractual exchange due to lack of alternative choice in the labour market is relatively frequent in modern economies that are

characterized by a globalized labour market, mergers and organizational downsizing, rapid technological change, and a high level of job instability.

'Strategic choice' is a second condition of non-symmetric exchange. Here, people accept high-cost/low-gain conditions of their employment for a certain time, often without being forced to do so, because they tend to improve their chances of career promotion and related rewards at a later stage. This pattern is frequently observed in the early stages of professional careers and in jobs that are characterized by heavy competition. As anticipatory investments are made on the basis of insecure return expectancy, the risk of failed success after long lasting efforts is considerable. In fact, negative life events resulting from overt contract violation were shown to exert particularly harmful effects on people's well-being and health.[6,7]

Thirdly, there are psychological reasons for a recurrent mismatch between efforts and rewards at work. People characterized by a motivational pattern of excessive work-related 'overcommitment' may strive towards continuously high achievement because of their underlying need for approval and esteem at work. Although these excessive efforts often are not met by adequate rewards, overcommitted people tend to maintain their level of involvement. There is reason to believe that this motivational style affects the way of how demands are appraised and responded to. Perceptual distortion prevents overcommitted people from accurately assessing cost–gain relations. As a consequence, they underestimate the demands, and overestimate their own coping resources while not being aware of their own contribution to non-reciprocal exchange. Work-related overcommitment is elicited and reinforced by a variety of job environments, and is often experienced as self-rewarding over a period of years in occupational trajectories. However, in the long run, overcommitted people are susceptible to exhaustion and adaptive breakdown (see below).

In summary, the model of effort–reward imbalance at work maintains that non-symmetric contractual exchange is frequent under these structural and personal conditions, and that people experiencing dependency, strategic choice or overcommitment, either separately or in combination, are at elevated risk of suffering from stress-related disorders. Moreover, given the evolutionary significance of the norm of reciprocity, non-symmetric exchange experienced in other types of social contracts in adult life may produce similar effects on health (see below).

In the following section, selected empirical evidence in favour of this theoretical approach is summarized in order to illustrate its validity. Details on the measurement of effort-reward imbalance at work can be found elsewhere.[8] However, it should be mentioned that 'effort' and 'reward' are measured by two uni-dimensional scales containing 6 and 11 Likert-scaled items respectively. Imbalance is assessed by applying a standardized algorithm (ratio effort/reward).

'Overcommitment' is equally measured by a scale containing six items in its short version. Reliability, factorial structure and different types of validity of these scales were analysed (for a description of measures of non-symmetric exchange in other core social roles see Ref. 9).

Scientific evidence

Several sources of information on associations between non-reciprocal contractual exchange and health are available, such as data from cross-sectional and case-control studies, from prospective epidemiological observational investigations, from studies using ambulatory monitoring techniques or experimental designs and from intervention trials. The prospective epidemiological observational study is considered a gold standard approach in this field because of its temporal sequence (exposure assessment precedes disease onset), its sample size (based on statistical power calculation and allowing for adjustment for confounding variables in multivariate analysis) and the quantification of subsequent disease risk following exposure (relative risk of exposed versus non-exposed subjects). The following selective presentation of associations between asymmetric exchange in terms of the model of effort–reward imbalance at work (exposure) and different types of disease is restricted to prospective studies for these methodological reasons.

Table 1 summarizes the results of 12 epidemiological reports on associations of effort–reward imbalance at work with disease onset that are available to date. Relative risks of health outcomes are calculated by estimating odds ratios (OR) or hazard ratios (HR), based on multivariate logistic regression analysis. The confidence intervals of these risks are not reported here, but all except two ratios are statistically significant in the expected direction: a high imbalance between effort and reward increases the risk of disease onset.

Significantly elevated odds ratios or hazard ratios vary between 1.3 (lowest) and 4.5 (highest), with an overall mean of about 2.0. This means that people who experience failed reciprocity at work (high effort and low reward) are twice as likely to suffer from one of the health risks under study in their near future, compared with people who are free from this type of chronic psychosocial stress. Elevated risks cannot be attributed to the influence of relevant confounding factors.

The observation period in these studies varies widely from one year to about 25 years (mean eight years). In most studies, the measurement of exposure (effort–reward imbalance) is restricted to baseline assessment. We now know that cumulative or chronic effort–reward imbalance over a longer period of time is associated with higher risk, compared with single (baseline) assessment. It is therefore possible that the relative risks indicated in Table 1 represent conservative

Table 1. Effort-reward imbalance at work and health outcomes: review of prospective epidemiological studies

First author (year)	Total sample (per cent women)	Country	Observation period (years)	Health outcome	Relative risk (odds ratio [OR], hazard ratio [HR])
Siegrist (1990)[17]	416 (0)	Germany	6.5	incident fatal or non-fatal CHD	OR 4.5
Lynch (1997)[18]	2297 (0)	Finland	8.1	incident CHD (myocardial infarction)	HR 2.3
Bosma (1998)[19]	10308 (33)	UK	5.3	incident CHD including angina	OR 2.2
Kuper (2002)[20]	10308 (33)	UK	11.0	incident CHD	HR 1.3 (1.8*)
Kivimäki (2002)[21]	812 (32)	Finland	25.6	cardiovascular disease mortality	HR 2.3
Kumari (2004)[22]	8067 (30)	UK	10.5	incident type II diabetes	OR 1.6 men; OR 0.9 # women
Stansfeld (1999)[23]	10308 (33)	UK	5.3	mild to moderate psychiatric disorder (mostly depression)	OR 2.6 men; OR 1.6 women
Godin (2004)[24]	1986 (46)	Belgium	1.0	depression	OR 2.8; OR 4.6
				anxiety	OR 2.3 men; OR 4.5 women
Kuper (2002)[20]	6918 (33)	UK	11.0	poor self-rated functioning (SF36)	*physical* OR 1.4 *mental* OR 2.3
Stansfeld (1998)[25]	10308 (33)	UK	5.3	poor self-rated functioning (SF 36)	*physical* OR 1.4 men; OR 2.0 women *mental* OR 1.8 men; OR 2.3 women
Niedhammer (2004)[26]	6286 (30)	France	1.0	poor self-rated health	OR 1.8 men; OR 2.2 women
Head (2004)[27]	8280 (31)	UK	5.3	alcohol dependence	OR 1.9 men; OR 1.2# women

*effort–reward imbalance in combination with low social support at work
#statistically non-significant
Abbreviations: CHD: coronary heart disease; SF 36: short form 36 health survey; UK: United Kingdom

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estimates. However, it must be noted that, in some studies, proxy-measures of effort–reward imbalance were used as the original scales were not yet available at study onset.

As can be seen from Table 1, the available evidence is stronger for men than for women, and it is stronger for coronary heart disease than for other health outcomes. Yet, evidence of similar strength is independent of whether self-reported 'soft' endpoints or clinically defined 'hard' endpoints are used. Seven out of 12 studies rely on data from the United Kingdom – the Whitehall II study of British civil servants.[10] Two studies come from Finland (different samples), and the remaining investigations are from Belgium, France and Germany.

In summary, there is solid evidence indicating that failed reciprocity in a core social role, the work role, represents an independent risk factor of a variety of highly prevalent diseases, especially so among middle-aged men. Supporting data come from laboratory and ambulatory monitoring research on male employees with continuous cardiovascular and hormonal data monitoring over one or several working days. They indicate elevated cardiovascular activation and increased cortisol secretion under high psychosocial work-related stress. These effects are attributed in part to the extrinsic (effort-reward ratio), in part to the intrinsic (overcommitment) component of the theoretical model.[11, 12]

More recently, several studies were conducted to test associations of non-symmetric exchange with health in close social relationships, in particular the marital or partnership relationship, the relationship between parents and children, and non-specified negative exchange in civic life, often experienced as a stressful life event (e.g. being betrayed or being let down by someone). As these studies are cross-sectional and as the measure of health (depressive symptoms as measured by the CES-D scale[13]) is based on self-reported data, the currently available evidence is less strong than that derived from the prospective investigations described above. Nevertheless, consistent findings from four different studies are available that are summarized in Table 2. In all studies the three measures of non-symmetric exchange in close social relationships are associated with significantly elevated risks of experiencing depressive symptoms (odds ratios vary from 1.7 to 4.0, compared with odds ratios of 1.0 in the respective group of people who are not exposed to non-symmetric exchange). Study 1 was conducted with a group of middle-aged male and female employees,[14] data from studies 2 and 3 were based on two surveys of older people in the United States of America and Germany,[9] and data from study 4 contain currently unpublished baseline data of a prospective investigation of cardiovascular risk in a representative urban population aged 45 to 75.[15]

Table 2. Non-reciprocal social exchange in close social relationships and depressive symptoms (CES-D scale; upper tertile) (results from 4 studies): Odds ratios (OR)* and 95%-confidence intervals (CI), derived from multivariate logistic regression analyses.

	Study 1 ($N = 316$)		Study 2 ($N = 682$)		Study 3 ($N = 608$)		Study 4 ($N = 1755$)	
	OR	95%-CI	OR	95%-CI	OR	95%-CI	OR	95%-CI
parent-children	4.00	2.15; 7.45	2.44	1.47; 4.06	1.77	0.95; 3.28	2.45	1.6; 3.6
partnership	3.79	2.15; 6.69	2.33	1.50; 3.62	1.85	1.21; 2.81	3.32	2.4; 4.6
non-specified negative exchange	2.07	1.23; 3.50	2.50	1.65; 3.79	2.47	1.64; 3.71	1.97	1.5; 2.5

*adjusted for age, sex, socio-economic status

Concluding remarks

In the scientific discipline of sociology, the fundamental unit of analysis is not an organism or an individual person, as is the case in biology or psychology, but rather a system of interacting individuals. Therefore, the notion of symmetry concerns a property of a system, and more specifically of a system of mutual exchange relations. In this perspective, symmetry in exchange results from compliance with the norm of social reciprocity where cooperative efforts are reciprocated by equitable return. Symmetry breaking as a consequence of violating the norm of social reciprocity is likely to occur in all human societies. Risks are increased in individuals whose need fulfilment depends on other persons, whether or not the respective cooperative exchange is regulated by social contract. As was shown in the case of the employment contract, symmetry breaking can manifest itself in several ways, ranging from overt contract violation to subtle forms of inadequate return, from material deprivation to emotional disregard or lack of esteem.

In all these instances, the degree of experienced unfairness triggers the emotional and behavioural consequences of symmetry breaking. This experience is processed in specific structures of the human brain, the so-called brain reward system. These brain structures include the prefrontal and orbitofrontal cortex, anterior cingulate, thalamus and the mesocortico-limbic dopamine system with projections to the nucleus accumbens, hippocampus, amygdala and hypothalamus.[16] Given an extensive corticostriatal-hypothalamic-brainstem network

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involved in reward-sensitive information processing, it is probable that non-symmetric contractual exchange resulting in sustained experience of social reward deficiency affects bodily systems via these pathways. Ultimately, the onset of stress-related disorders is mediated by these pathways.

Although more research evidence is needed to bridge the gap between two lines of scientific inquiry – epidemiological studies linking features of the social system with disease occurrence, and neuroscience concerned with the way the brain deals with the social world – the available results summarized above are promising in this perspective. They underline the importance of symmetry as a basic property of living systems and as a scientific concept to advance transdisciplinary research.

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