# Precedent Transfer in Coordination Games: Experimental Evidence*

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**Abstract**

In this work we study the power of precedent transfer in improving coordination in the minimum effort game with large groups. We test whether groups which play a different coordination game in which chances to reach the best equilibrium are higher than in the minimum effort game can then transfer the homegrown precedent of efficiency to the minimum effort game, achieving better coordination results compared to baseline treatments. We also test whether the opposite holds, i.e., whether inefficient precedents achieved by groups in the minimum effort game negatively affect the subsequent probability of reaching the efficient equilibrium in similar games. Our results show that efficient precedents are generally transferred successfully to the minimum effort game, allowing groups to achieve better equilibrium outcomes compared to standard results.

**JEL codes:** C72, C92

**Keywords:** critical mass games, minimum effort games, coordination, equilibrium selection, precedent transfer, trust

# 1 Introduction

It is becoming a largely acknowledged fact that *trust* is an important component of a good organizational environment. Its importance in the organizational literature is signaled by the rapid growth of recent studies on trust that often address the problem from an interdisciplinary perspective (e.g., Bies and Tripp, 1996; Kramer, 1999; Kramer and Isen, 1994; Kramer and Tyler, 1996; Rousseau and Tijoriwala, 1999; Zaheer, McEvily, and Perrone, 1997). In a recent article, Dirks and Ferrin distinguish between a more traditional view of trust as a general psychological attitude straightforwardly inducing higher effort and cooperation in the pursuit of organizational goals, and a more operational notion of trust as "an expectation or belief that one can rely upon another person's actions or words, and/or that the person has good intentions toward oneself" (Dirks and Ferrin, 2001, p. 451). In particular, the studies that follow the second approach stress the idea that trust influences individuals' *expectations* about other persons' actions and behavior, leading in turn to the choice of more risky actions in interactive settings, and ultimately increasing the likelihood of better organizational performance (Dirks and Ferrin, 2001; Mayer, Davis and Schoorman, 1995). This second definition of trust is particularly well suited to be empirically studied through the analytical framework of coordination games. Recently, Camerer and Knez (1994, 1996a, 1996b) and subsequently Foss (2001) have argued for a new approach to organizational behavior that builds upon behavioral game theory; in doing so, they assign special attention to coordination games, in which the level of mutual trust is crucial - among other things - in determining the emergence of efficient versus inefficient behavioral conventions.

In this paper we focus on the minimum effort game (VanHuyck, Battalio, and Beil, 1990), which is a stylized model of all organizational and production activities which are carried on in a decentralized manner by different individuals or firms, but whose output is sensitive to the worst input. In all these cases, the inputs or activities are highly interdependent, so that a single 'bad apple' may be enough to compromise the whole result, and render the contributions of 'good apples' ineffective (see also Cooper, 1999). In the game every players faces a tradeoff between the desire to coordinate on the efficient outcome, and the need to assure oneself against the risk that not everybody else will do their part to foster efficiency. A high level of mutual trust between players is all that would be needed to achieve efficient coordination; however, the tight interdependence between players' choices renders it very difficult for mutual trust to develop; in fact, it only takes one player selecting an 'inefficient action' to disrupt the Pareto-optimal equilibrium. Further, the probability that at least one player will do so increases with group size. In fact, many experiments have shown that efficient coordination in the game is very difficult to achieve and it is less likely, *ceteris paribus*, the larger the groups (i.e., 3 or more players; see section 3 for a review of related work).

In this paper we investigate the power of *precedent transfer* in increasing efficiency in the minimum effort game when large groups of players are involved. In particular, we intend to test whether some precedent of efficient play previously achieved by a group in a coordination game in which interdependence between choices is less extreme than in the minimum effort game may subsequently be transferred to the minimum effort game, allowing groups to reach higher payoff equilibria than in the baseline treatments. Our hypothesis is that groups which are let able to interact in a less penalizing coordination environment than the minimum game are more likely to develop good level of trust, which may be then successfully transferred to the minimum game setting.

We design a simple n-person coordination game which we call the Critical Mass game. The game is in many respects similar to the minimum effort game, but with a different payoff structure which, as will be better clarified in section 3, renders interdependence between players' choices less extreme than in the minimum effort game, and it puts a greater incentive toward unanimous behavior. Moreover, we test a further variation of the critical mass game in which we add *increasing returns* in the number of players choosing the same action. The addition of increasing returns, as some economic literature has shown (e.g., Arthur, 1989) should increase, other things being equal, the incentives toward unanimous behavior, though not necessarily increase the chances of reaching efficient outcomes.

Pilot experiments conducted on the two versions of the critical mass game reveal that both coordination on the efficient equilibrium and convergence *tout court* (to any equilibrium) are on average more likely than in the minimum game. Hence, we ask whether groups which are able to reach the efficient equilibrium in this game can subsequently transfer this precedent of efficiency to the minimum game environment. Similarly to a *positive transfer* effect, in which a precedent of efficient coordination - and hence the group's homegrown 'expectational assets' (Camerer and Knez, 1994) - get transferred to a new situation, we also want to investigate the existence of *negative transfer* effects. For this reason, we study whether inefficient precedents experienced by groups in the minimum game negatively affect the groups' subsequent coordination in the critical mass game. If that occurs, it would imply that a penalizing interactive situation creates mutual distrust or expectational liabilities which cannot easily be washed away once the interactive setup becomes more favorable to the development of mutual trust. Our results can be summarized as follows: most groups succeed in transferring the homegrown efficient precedent achieved in the critical mass game to the minimum effort game. Negative transfer, on the other hand, occurs only in half of the cohorts. We provide a psychological explanation for this effect.

The motivations and implications of our work are twofold. First, it can help highlight the organizational conditions that favor the emergence and stability of trust in highly interdependent tasks such as those exemplified by the minimum effort game, with possible implications for organizational design. Second, it may contribute to the understanding of the mechanisms that govern cross-games transfer, and thus contribute to shed some light on the (admittedly, much more complex) process of transfer of behavioral routines and norms in situations of organizational change.

The paper is organized as follows. Section 2 reviews previous related work on precedent transfer and their relevance for the study of organizational behavior. Section 3 presents the two games and the experimental design. Section 4 analyzes the results. Section 5 presents a discussion of the paper's main findings and section 6 offers some concluding remarks.

## 2 Transfer of Precedent: Related Work

Psychological studies on transfer have mostly focused on individual problem solving. What these studies show is that transfer of knowledge is tightly linked to our ability to think analogically, i.e., to perceive abstract (higher-order) similarities between instances (Holyoak and Thagard, 1996). However, often the recognition of such deeper similarities may be impeded by the presence of more superficial, perceptual similarities which may lead astray.

There are reasons to assume that several analogies exist between transfer of knowledge in individual tasks and collective transfer of actions, decision rules or shared representations in interactive settings. For example, Knez and Camerer (2000) point out that many organizations implicitly rely on analogical transfer in their effort to build mutual trust among employees. Many training practices based on teamwork, they argue, count on the development of reciprocal trust among team members in a very specific, ad-hoc situation and on its subsequent transfer to the more regular organizational life once the training is over. Foss (2001) argues that many organization members rely a great deal on analogies with past interaction situations in the effort to achieve efficient coordination outcomes in the present.

Of course, when dealing with interactive domains and especially with games of coordination, transfer (which supposedly acts at the individual level) is necessarily intertwined with issues of *salience* or *focality* (Schelling, 1960), which typically pertain to the nature of interaction. In his famous work on the origin of conventions, Lewis (1969) states that coordination based on precedent requires that players focus on some salient analogy between the present game and some past instance, and that they expect others to focus on the same analogy. Therefore, in coordination problems, the perceived similarity between the present and the past must be shared by all players involved, and it must regard the same (superficial or deep) elements.

Other experiments have tested transfer in games of coordination. VanHuyck, Battalio, and Beil (1991) studied transfer in the median action game; they found weak evidence of transfer of precedent in itself, when this did not coincide with the efficient outcome. However, they found that weak precedents of efficient play did improve efficiency in subsequent play of the same game with different parameters of the payoff function.

Knez (1998) studied transfer of precedent from 2-player to 3-player conflict-of-interest games, and he found that when players experienced play of the equal-payoff equilibrium in the 2-player case they were subsequently more likely to play the action supporting the equal-payoff equilibrium in the 3-player case. However, subjects were also more likely to select the action supporting the alternative, coalitional equilibrium in the triad, suggesting that the mechanisms that govern transfer of precedent are not so obvious and transparent as they may seem and call for further investigation.

Knez and Camerer (2000) studied transfer of precedent from the weak link to the Prisoner's Dilemma game in small groups and found out that precedents of efficiency in the minimum effort game fostered a higher amount of cooperation in the PD than normally observed. However, they also found that transfer of efficient play strongly depended on the presence of superficial similarity (what they call 'descriptive' similarity) between the two games. In fact, when actions were numbered differently in the two games, transfer did not occur.

# 3 The games

## 3.1 The Critical Mass Game

"Critical mass" in the context of this game is simply a synonymous for a threshold level (expressed in terms of number of people), below which players who choose a certain action are not rewarded. Besides, higher-payoff actions are characterized by higher thresholds[1].

Real-world examples of the critical mass game concern processes of organizational change where different sets of norms and routines (regarding, e.g., division of labor among divisions, offices, or co-workers) may typically differ on the degree of strategic interdependence they introduce among members: low-interdependence norms usually present a high level of redundancy against "break-downs" but are relatively inefficient; on the other hand, more efficient norms may require the effective contribution of more (or all) organization members in order to be effective. A related example concerns the gradual introduction of a new norm or behavioral standard (e.g., David and Greenstein, 1990), which may adopted over time by an increasingly large proportion of organization members.

In the game, $K$ players have to pick numbers in a certain range and the payoff from picking number $i \in (1, I)$ is given by the following function:

$$\pi_i = \begin{cases} \alpha i & \text{if } k_i \geq i \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

where $k_i \leq K$ is the number of players who choose number $i$, and $\alpha$ is a positive constant. In more descriptive terms,

- each player's payoff increases linearly with the number chosen, conditional to the critical mass associated to that number being reached

- higher numbers require higher critical masses (i.e., more players picking the same number) in order to yield positive payoffs

If $I$ is put equal to $K$, the critical mass necessary to achieve the highest payoff corresponds to the totality of players.

[1] Similar step-level payoff functions characterize several experimental public goods games (e.g., Ledyard, (1995) for a review.)

The payoff function is designed so that once the threshold level is reached in correspondence of a particular number, then payoffs remain constant if additional players join.

The following variation of the payoff function introduces an additional element, namely the existence of *increasing returns* in the number of players choosing the same strategy:

$$\pi_i = \begin{cases} \alpha i + k_i - 1 & \text{if } k_i \geq i \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

Now, once a given quorum is reached, individual payoffs associated to a number increase by one unit as each additional player joins.

Equations 1 and 2 give rise to the payoff tables 1 and 2 for the simple case in which $K = I = 7$, and $\alpha = 1$.

= Table 1 here =

= Table 2 here =

The tables' rows report each player's feasible actions, that is integers from 1 to 7. Columns report, for each integer, the total number of players who pick that integer. It is easy to see that the game has seven strict Nash equilibria in pure strategies, corresponding to the seven action combinations in which all players choose the same number (they correspond to the last column of the payoff table). The equilibria can be Pareto-ranked, with the $n - tuple(7, \ldots 7)$ being the efficient equilibrium. The $n - tuple(1, \ldots 1)$ equilibrium, however, is implemented by security.

### 3.2 The Minimum Effort Game

In the original minimum effort game (Van Huyck et al., 1990) players must pick integers in the [1,7] interval, and the payoff to a player is determined by the number he or she has chosen and the minimum number chosen in the group. Table 3 shows the payoff table for the minimum effort game that was used for our experiments.

= Table 3 here =

The $n - tuple(7, \ldots 7)$ corresponds to the efficient equilibrium, while the $n - tuple(1, \ldots 1)$ represents the secure equilibrium. Each player is penalized the further her choice is from the minimum in the group. Experiments on the minimum game have shown that the level of efficiency attained strongly depends on group size and on the length of the time horizon. When groups are large and when the number of round is 5 to 20, the worst outcome (i.e., the last round minimum equal to 1) almost invariably occurs. On the contrary, dyads are able to reach efficiency, and large groups as well can do it when the time horizon is considerably long (Berninghaus and Ehrhart, 1998). Other studies have shown that allowing pre-play communication (Cooper, DeJong, Forsythe and Ross, 1993) or auctioning the right to play (Van Huyck, Battalio and Beil, 1993), introducing forms of inter-group competition (Bornstein, Gneezy and Nagel, 1999), or changes in the payoff function that lower the cost of deviating from the minimum (Goeree and Holt, 1999) are all mechanisms that work in the direction of improving efficiency in the game. Other treatments, like allowing one player in the group to make a public speech before play (Weber, Rottenstreich, Camerer and Knez, 2001), or announcing the entire distribution of choices in the group after each round rather than just the minimum (Van Huyck et al., 1990) do not have positive effects instead, in the former case replicating the baseline results, in the latter even speeding up the convergence to the worst equilibrium. Our work extends these previous studies in the direction of testing the power of efficient precedent in improving coordination in large groups.

The critical mass and minimum effort games share several surface similarities. In the design implemented here, both games involve the choice of numbers from 1 to 7, and in both games the secure and the efficient equilibria are implemented by the same two actions. In addition, the games share structural (more abstract) similarities, since they are both games of coordination with multiple, Pareto-ranked equilibria. However, the type of interdependence between players' decisions is different in the two games. In the critical mass game, with or without the presence of increasing returns, payoffs depend on absolute frequencies of players picking a certain action, while in the minimum game individual payoffs are linked to an order statistic of all numbers chosen. Moreover, unlike in the minimum effort game, interdependence in the critical mass game is a matter of degree, in the sense that the higher the action, the higher the need for players to coordinate. As numbers raise in the [1,7] range, however, the game increasingly resembles the structure of the minimum effort game, since the influence of low efforts on individual payoffs increases, and the two games are substantially equivalent in correspondence of the Pareto-optimal equilibrium. In a loose sense, hence, the critical mass game is a gradual version of the minimum effort game.

### 3.3 The experimental design

All experiments were conducted at the Computable and Experimental Economics Laboratory (CEEL) at the University of Trento. Subjects were all students enrolled in different programs of study at the University of Trento, and were recruited by responding to ads posted at the various Departments. None of them had previously participated in experiments of this type. Twelve groups played the Critical mass game in its basic version (CM), and other twelve played the version with increasing returns (IR).

Of these, half groups were assigned to the *transfer* treatment, and played the minimum effort game (ME) afterwards. Two control treatments were conducted in which the previous two sequences were reversed. The four resulting treatments are summarized in table 4. We collected six independent observations per treatment except for treatment ME-CM, since three of the subjects enrolled for one of the sessions in this treatment did not show up.

= Table 4 here =

In accordance with the psychological literature on transfer and for ease of exposition, we will from now on refer to whichever of the two games is played first as the *source* game, and to the game being played second as the *target* game.

Each game was played for 14 periods, for a total of 28 periods of play for each experimental session. Sessions lasted 50 minutes on average, and no session lasted more than one hour. Earnings were expressed in "experimental points" to be converted in cash at the end of the experiment according to a certain exchange rate. The maximum earnings that each subject could receive in the experiment was set equal to 50.000 Italian Liras, roughly corresponding to $30.

An important part of the design procedure was the information feedback that subjects had after each round of play. In fact, in all treatments *the entire distribution of choices in the group was announced to players after each period in both games*. Subjects were randomly assigned to different treatments upon arrival, and each was randomly assigned a seat at one of the terminals of the computer cluster at CEEL. Subjects could see each other but no form of communication or pre-play negotiation was allowed. Payoff tables used in the experiments were the ones shown in the tables 1, 2, and 3. Players were provided with a written copy of the instructions [2]and with a copy of the payoff table. Instructions were read aloud at the beginning of the experiment, to make sure that everybody understood the rules and to assure subjects that everybody had received identical instructions.

At the beginning of the experiment in the transfer treatments, players were told that the experimental session would consist of two, unrelated parts. Then the instructions for the *source* game were read aloud. Before the actual experiment began, subjects had to fill in a questionnaire to assure that everybody had understood how to assign points according to the payoff table. At the end of the fourteen periods of play of the source game, subjects received new instructions and a copy of the new payoff table. The groups always remained the same in the new game, and this was explicitly stated in the instructions. Before starting the new game, subjects had to fill in another questionnaire.

# 4 Results

## 4.1 First period choices

We first compare first round choices in the same game depending on whether it was the *source* or the *target* game. Table 5 reports first period choice distributions in all three games, together with the mean and standard deviation values [3].

= Table 5 here =

The percentage of subjects picking the efficient action 7 in the first period of the ME game after they have played either the CM or IR games is more than doubled compared to when the same game is played first. The difference in the two distributions is statistically significant by a Kolmogorov-Smirnov test at conventional significance levels ($Z = 1.722$, $p < .005$).

The percentage of players picking 7 in the CM (target) is likewise higher than in the CM (source), while such percentage *decreases* from the IR (source) (40.5%) to the IR (target) (31%). The distri-

[2]A sample copy of the instructions is shown in the Appendix.

[3]First period choice distributions as well as average choices in the source game include groups which played either the CM or IR games only.

butions, however are not statistically different by the same Kolmogorov-Smirnov test.

Looking at the overall focality of precedent (whether efficient or inefficient), only 53 players (33%) choose the same action in period 14 and 15, i.e., in the *last* period of the source game and in the *first* period of the target game. Only 17 (10.5%) concern a choice *other* than 7. Hence, the historical precedent represented by previous period play in the source game seems scarcely relevant in itself in shaping choices in the new game. Of the remaining subjects, and excluding those who selected 7, 75.5% choose a higher action than the one chosen in the last round of the source game. Hence, players in the new game seem willing to explore in the direction of higher payoff actions.

Comparing the results of groups' behavior in the same game in two different conditions (with or without previous experience in a similar game), however, does not allow one to distinguish between the effects of precedent transfer from the sheer effects of learning from experience. In principle, the effects of learning - when observed at the group level - should always be positive, regardless of the efficiency level achieved in the source game. If the effects are due to transfer of precedent (i.e., transfer of trust or distrust), however, we should observe some correlation between the results achieved in the source game and that achieved by the same group in the target game. In other words, if groups learn, they should be able to learn from a coordination failure as well as from a coordination success, therefore we should observe generalized improvements in coordination in the target games regardless of the 'goodness' of previous experience in the source games. Results of previous experiments have shown that the effects of experience in coordination games are generally negligible (e.g., Knez and Camerer, 2000). Disentangling completely between the two in our case would require comparing our results with results of other experiments in which the groups are 'scrambled' from the source to the target game, so that transfer of precedent could not apply. While this is beyond the scope of this paper, we will try to distinguish between the two effects throughout the analysis.

## 4.2 Convergence

**The CM-ME and IR-ME treatments** Recall that our hypothesis on positive transfer states that, since reaching efficiency in the CM or IR games is more likely than in the ME game, groups that converge to the efficient equilibrium in the CM/IR games should be able to transfer this efficient precedent to the ME game. Consequently, provided that some groups do achieve efficiency in the CM/IR games, we should observe convergence to the efficient equilibrium more often in the

ME(target) than in the ME(source).

Table 6 reports the correlation coefficients between choices in the last round of the source games and choices in the first round of the target games, divided by treatment. Tables from 7 to 10 report, separately for each cohort, the number of subjects who selected each number in the last round of the source game, and in the first and last rounds of the target game, and the Appendix reports individual data for all games and treatments.

= Table 6 here =

= Table 7 here =

= Table 8 here =

= Table 9 here =

= Table 10 here =

We therefore focus on both *immediate* transfer, which implies a positive correlation between choices in the last round (source) and choices in the first round (target), and *structural* transfer exemplified by convergence to the efficient equilibrium at some point in the ME game conditional on the outcome achieved in the CM/IR games (see, e.g., Ho, Camerer and Weigelt 1998). There is evidence of immediate transfer in both the CM-ME and IR-ME treatments, since the correlation between choices in the last round (source) and first round (target) is positive and significant. The correlation, however, is much higher in the IR-ME case. Convergence data in the ME(source) game, which are used here as a control treatment, substantially replicate previous results. In fact, no group converges to the payoff-dominant equilibrium. Moreover, the last period outcome is the *worst* possible outcome in ten of the eleven groups.

Incidentally, note that, unlike the standard design in the minimum effort game, in which only the minimum is announced, in our design the entire distribution of choices was rendered public after each round. In order to detect differences due to the information treatment, we compared our data with results from Bornstein et al. (1999)[4] on the minimum effort game with same group size (i.e., seven) and a 'minimum only' information treatment.

While first period choice distributions are different at a .0021 significance level by a Kolmogorov-Smirnov test [5], nonparametric tests on mean choices per period, and ANOVA on individual choices do not show any statistical difference in subsequent rounds.

In the ME (target), unlike the ME (source), seven groups out of twelve converge to 7. Three of the six groups manage to reach the efficient equilibrium in the CM game (group 1, 2 and 6). All three groups are subsequently able to replicate the result in the ME game, although in group 1 the efficient equilibrium is not sustained until the game's end (the group coordinates on 7 in period 7 of the ME game). Among the three groups (3, 4, and 5) not converging to the optimal equilibrium in the CM game, only group 4 manages to converge to such equilibrium in the ME game.

The remaining two groups (3 and 5) manage to reach almost perfect coordination on 3 at the end of the CM game. However, choices in the first round ME are again disperse, and both groups nearly converge to 3 at the end of the ME game, thus substantially replicating the inefficient precedent achieved in the source game[6].

Combining data from all sessions in the CM-ME treatment, the overall percentage of choices equal to 7 (i.e., the highest effort) increases from 31% in the CM game to 65.8% in the ME game ($\chi^2 = 375.1$, $p < .0005$).

In the IR-ME treatment, choices equal to 7 remain nearly invariant between the two games, passing from 60.5% to 57.6%. In the IR game four of six groups (3, 4, 5, and 6) converge to 7 by the last round, and all except group 3 succeed in transferring this precedent to the ME game [7], while group 3 almost converges to the worst equilibrium.

Of the remaining two cohorts, cohort 2 reaches an equilibrium on 5 at the end of the IR game,

[4] I am very grateful to Rosemarie Nagel for letting me use their data.

[5] Counter-intuitively enough, first period choices in our treatment are *less* concentrated on 7 than choices in their treatment.

[6] In one group this becomes a mutual best response outcome in the last three periods.

[7] In cohort 5 this equilibrium was subsequently 'broken' by two players, but other players kept picking 7.

but this historical precedent has no role in coordinating choices in the ME game, in which the group converges to the minimum effort. Cohort 1 never reaches an equilibrium in the IR game; however, the last round minimum effort in the ME game is equal to 4.

Some observations are noteworthy: first, as hypothesized and as suggested by pilot experiments, coordination on the efficient equilibrium in the CM and IR games in on average observed more frequently than in the ME game. Limiting ourselves to consider the groups that were assigned to the transfer treatment, half of the six groups that played the CM game coordinated on 7, while four of the six groups that played the IR game achieved the same result. Second and most important for the purpose of this paper, efficient precedents developed in these games are generally transferred with success to the ME game, allowing groups to attain significant improvements in performance compared to baseline treatments. In fact, of the seven groups that overall are able to coordinate on the efficient equilibrium in the CM/IR games, six are able to successfully transfer this outcome to the ME game, whereas all the remaining groups except one replicate an outcome of inefficiency. Third, the sheer effect of previous experience is instead weak; in fact, if groups develop a homegrown precedent of inefficiency in the CM/IR game, they are not able (except in one case) to correct their actions and expectations over time when playing the ME game. An efficient precedent seems thus a necessary - although not always sufficient - condition to achieve the same result in the ME game. Note, however, that even when transfer of efficient precedent does occur, only in one case it is immediate, i.e., it occurs in the first round of the ME game. Finally, not all groups that achieve successful coordination in the ME game are able to sustain such equilibrium for an extended period of time[8].

**The ME-CM and ME-IR treatments** Let us now turn to the negative transfer hypothesis. More specifically, we intend to check whether a precedent of inefficiency in the ME game creates expectational liabilities which negatively affect the level of efficiency attained in the CM/IR games compared to baseline treatments.

The frequency of 7 choices in the ME-CM treatment passes from 17.1% in the ME to 74% in the

[8]We don't know the extent to which players' occasional deviations from the Pareto-efficient equilibrium in the minimum game may be due to boredom, or 'variety-seeking' behavior. In any case, the costs of such deviations probably matter. In the minimum game, a player picking, say, 6 when all others choose 7 earns one point less than the maximum. In the critical mass game the same player earns nothing. An analogous behavior had been found in the minimum effort game by Berninghaus and Ehrhart (1998) and had been labelled 'the spite effect'.

CM game ($\chi^2 = 320$, $p < .0005$). Hence, the salience of efficiency gets substantially strengthened by previous experience.

All five cohorts in the ME-CM treatment show a downward drift in choices in the ME game, with a last round minimum of 1 in each cohort. Hence, the historical precedent developed in the source game is an inefficient outcome for all groups. However, the is virtually no correlation between last round choices in the ME game and first round choices in the CM game. In addition, four of five groups subsequently succeed in converging to the payoff-dominant equilibrium in the CM game, and one group succeeds in raising the equilibrium from 5 to 6. Furthermore, convergence is relatively fast, occurring in five periods or less.

In this case, hence, there is no evidence of a negative transfer effect. Moreover, the effect of previous experience is significantly positive, driving the majority of groups toward fast coordination on 7 in the CM game.

Finally, in the ME-IR treatment, five of six cohorts exhibit a minimum choice of 1 in the last period of the ME game, and one cohort achieves a minimum of 3. This cohort is the only one that subsequently succeeds in coordinating on the efficient equilibrium in the target game. Cohorts 1, 5, and 6 reach an equilibrium, respectively, at 2, 1 and 5 in the IR game, and the remaining two show a last period modal choice of, respectively, 1 and 5.

There is no significant correlation between subjects' choices in round 14 and round 15, and the relative frequency of observed choices of 7 does increase from 11% to 27.5% ($\chi^2 = 47.44$, $p < .0005$) from the ME to the IR, suggesting that previous experience renders the efficient equilibrium more salient. However, the group dynamics go in the opposite direction. In particular, what stands out from the results of the IR (target) treatment is group coordination on low effort equilibria, which never occurred in the IR (source). The historical precedent in itself is not salient in coordinating choices in the target game. In fact, only 24% of players choose the same action in periods 14 and 15. 54% choose a higher effort, and the remaining 22% lower their effort.

## 5 Discussion

The comparison between results in the CM/IR-ME and the ME-CM/IR treatments might suggest that transfer of precedent is 'game-specific' and 'direction-specific', although this in turn triggers the further question: what is it exactly that players transfer from one game to another? Our results suggest that precedents are transferred only when they are efficient. In fact, the precedent achieved in the source game is not salient *per se* in the target game, unless it is a precedent of efficiency. Moreover, choices consistent with efficiency considerations are generally increased by previous experience in a related game. Thus, it seems plausible that, at an individual level, some learning occurs, and experience in the source game increases subjects' willingness to try to implement the efficient equilibrium, also through active signaling to other players. In fact, the full information treatment allows players to try to influence others' behavior through their choices of efforts. However, previous experience alone is not sufficient to eliminate strategic uncertainty in all but the ME-CM treatment. A factor that may account for the anomaly of the ME-CM case is related to subjects' sensitivity to payoffs. Various experiments on coordination games show that the dynamics of play are determined by both beliefs about other players' choices, and by payoff considerations. For example, in minimum effort games in which the costs of deviations from equilibrium (in terms of foregone payoffs) are lowered to negligible values, convergence to the best outcome gets substantially increased as players are more inclined to exploration toward more efficient actions (Gooere and Holt, 1999; Straub, 1995). Therefore players are influenced, among other things, by how costly (or, symmetrically, rewarding) it is to abide to any selection principle. In a similar way, payoffs may play a role in transfer between games. In our experiments, the minimum payoff that players can achieve in the ME game is equal to 7 points, while the same payoff of 7 points can be earned in the CM game only if the whole group coordinates on the efficient equilibrium. Consequently, any payoff other than the maximum earned in the CM game could have been perceived by players as a 'loss' with respect to the reference point represented by the payoff earned in the ME (source). This perception, combined with the principle of *loss aversion* (Kahneman and Tversky, 1979) , i.e., the tendency to be relatively more risk-seeking in the domain of losses with respect to the domain of gains, might explain why groups coordinated so fast on the efficient equilibrium in the CM (target), despite a homegrown precedent of inefficiency[9]. While this conjecture will have to be verified by further experiments, our results add evidence to the idea that analogical transfer in interactive settings is a complex combination of learning and psychological principles that act at the individual level (e.g., perceptions of similarity), and expectations about how other players will abide to those same principles, which we labelled as

[9]This interpretation, if valid, implies also that players were sensitive to points earned rather than to their corresponding monetary value. The point/Liras exchange rate, in fact, varied across games.

*trust*. In addition, transfer in games is sensitive to a variety of contextual factors, much similarly to transfer in individual problem-solving tasks, which renders it difficult to predict *a priori* how it will act on the sole basis of abstract, game-theoretic considerations.

## 6 Conclusions

The aim of this paper was to test experimentally whether efficiency - as measured by the rate of convergence to the Pareto-optimal equilibrium - in the minimum effort game increases when players have a chance to learn to coordinate in a relatively less penalizing payoff environment and then, provided that they reach efficiency in such an environment, transfer this precedent to the minimum game.Our answer is largely positive. Of the seven groups out of twelve that achieve a precedent of efficiency in the CM or IR games, six are able to transfer it to the ME game, while none of the groups in the control treatment converge to the efficient equilibrium in the ME game. The graded interdependence implied by the critical mass game favors the development of mutual trust between players which is a necessary condition to implement coordination on efficient equilibria. This trust then resists to the external shock represented in our experiment by a change in the underlying payoff function.

In a similar and symmetric way, we asked whether groups who are exposed to the minimum effort game may develop expectational liabilities that transfer to new situations, negatively affecting the probability of achieving efficiency in the critical mass game. Our experiments provide a positive answer in one of the two treatments. Groups that play the ME game before achieve a poor efficiency level in the IR game compared to baseline results. This data suggest that negative mutual expectations possess a degree of inertia that is not easily washed away by a change in the underlying structure of interaction. However, in the CM-ME treatment, four out of five groups with a home-grown precedent of inefficiency in the ME game achieve fast coordination on the best equilibrium in the CM game. We provide a psychological explanation for this result based on subjects' sensitivity to payoffs and on the notion of *loss aversion*.

Note that the effects of positive transfer are not only present, but significant in magnitude, increasing the rate of coordination on the efficient equilibrium relatively more than other devices like the introduction of forms of intergroup competition (Bornstein et al., 1999). This result confirms that precedent transfer is a very powerful mechanism for improving both coordination and cooperation phenomena within organizations. It also points at a different variable to act upon to improve organizational performance, i.e. the structure of the interdependence between actors' choices of actions. Recent contributions in the management literature emphasize the role of local action and mutual adaptation in fostering coordination in large organizations, as opposed to rigid engineering design and control. In this new approach, one of the key design elements concerns the tuning of the interdependencies between tasks (e.g., Levinthal and Warglien, 1999). As our data and several other previous experiments have shown, efficient play by large groups in games of coordination varies substantially, even within structurally similar games, depending on the characteristic of the payoff function, i.e., on the underlying type of interdependence between players' actions. For this reason, we suggest that the manipulation of the interdependence might be a useful tool to favor the emergence of organizational expectations able to sustain efficient coordination over time. Further, the results suggest the importance of tuning the amount of organizational 'slack' to increase the chance of efficient outcomes. In particular, if the final desired state is one of efficient coordination in a minimum effort-type interdependence, where no slack is present, managers should start with a less extreme setting, in which the effects of the majority's choices cannot be frustrated by a single member acting differently. Moreover, managers in organizations should be warned on the fact that expectational liabilities, once formed, seem resistant to change even in the face of more favorable interactive conditions. However, the results also suggest caution when dealing with cross-experience transfer. In fact, in our experiments groups were able to transfer an efficient precedent across two games that are both descriptively and structurally similar.

However, we know from previous experiments by Knez e Camerer (2000) that the same does not happen in presence of structural similarity only. Furthermore, the contrast between results in the ME-CM treatment and the ME-IR treatment suggest that perceptions of similarity between games may involve other features beyond games' descriptions. In particular, players might focus on similarity between payoff levels implied by the choice of actions in the two games (i.e., the numbers within the cells of the payoff tables). Translated to the real world setting, this means that collective analogical transfer, much like individual transfer, may be influenced more by contextual elements than by abstract isomorphisms. Further experiments should investigate the role of payoffs in transfer of precedent; this could be done by manipulating the relative payoff magnitude in the source and target games leaving payoff functions unaltered to see whether changes in behavior would occur. In addition, more systematic research should be conducted to identify which context elements are likely to be more salient than others in guiding the transfer process. In order to so, however, it would prove useful to test transfer in context-rich interactive settings more closely resembling the complexity of real organizations.

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| Number I choose: | Number of players who choose number: | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 0 | 0 | 3 | 3 | 3 | 3 | 3 |
| 4 | 0 | 0 | 0 | 4 | 4 | 4 | 4 |
| 5 | 0 | 0 | 0 | 0 | 5 | 5 | 5 |
| 6 | 0 | 0 | 0 | 0 | 0 | 6 | 6 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |

Table 1: payoff table for payoff function 1, for $N = 7$ players

| Number I choose: | Number of players who choose number: | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2 | 0 | 3 | 4 | 5 | 6 | 7 | 8 |
| 3 | 0 | 0 | 5 | 6 | 7 | 8 | 9 |
| 4 | 0 | 0 | 0 | 7 | 8 | 9 | 10 |
| 5 | 0 | 0 | 0 | 0 | 9 | 10 | 11 |
| 6 | 0 | 0 | 0 | 0 | 0 | 11 | 12 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |

Table 2: payoff table for payoff function 2, for $N = 7$ players

| Number I choose: | Minimum number chosen: | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 7 | | | | | | |
| 2 | 6 | 8 | | | | | |
| 3 | 5 | 7 | 9 | | | | |
| 4 | 4 | 6 | 8 | 10 | | | |
| 5 | 3 | 5 | 7 | 9 | 11 | | |
| 6 | 2 | 4 | 6 | 8 | 10 | 12 | |
| 7 | 1 | 3 | 5 | 7 | 9 | 11 | 13 |

Table 3: payoff table of the minimum effort game

| Treatment | N. of periods | N. of cohorts |
|---|---|---|
| CM-ME | 28 | 6 |
| IR-ME | 28 | 6 |
| ME-CM | 28 | 5 |
| ME-IR | 28 | 6 |

Table 4: the four different treatments

| game | CM | | IR | | ME | |
|---|---|---|---|---|---|---|
| | source | target | source | target | source | target |
| mean | 4.08 | 5.2 | 4.8 | 4.45 | 4.5 | 5.2 |
| st. dev. | 1.93 | 1.91 | 2.01 | 2.09 | 2.12 | 2.35 |
| 1 | 9 (10.7%%) | 0 (0%) | 4 (4.8%) | 3 (7.1%) | 11 (14.3%) | 9 (10.7%) |
| 2 | 6 (7.1%%) | 3 (8.6%) | 5 (6%) | 6 (14.3%) | 3 (3.9%) | 6 (7.1%) |
| 3 | 21 (25%) | 6 (17.1%) | 20 (23.8%) | 7 (16.7%) | 10 (13%) | 6 (7.1%) |
| 4 | 20 (23.8%) | 7 (20.0%) | 13 (15.5%) | 8 (19%) | 15 (19.5%) | 5 (6%) |
| 5 | 8 (9.5%) | 2 (5.7%) | 7 (8.3%) | 2 (4.8%) | 9 (11.7%) | 2 (2.4%) |
| 6 | 1 (1.2%) | 0 (0%) | 1 (1.2%) | 3 (7.1%) | 5 (6.5%) | 4 (4.8%) |
| 7 | 19 (22.6%) | 17 (48.6%) | 34 (40.5%) | 13 (31%) | 24 (31.2%) | 52 (61.9%) |
| Tot. | 84 (100%) | 35 (100%) | 84 (100%) | 42 (100%) | 77 (100%) | 84 (100%) |

Table 5: Mean, standard deviation and distribution of first period choices by game and by treatment

| | CM-ME | IR-ME | ME-CM | ME-IR |
|---|---|---|---|---|
| Rho Spearman corr. coeff. | .276 | .605 | .073 | -.113 |
| Sig. (one-tailed) | .039 | .01 | no | no |

Table 6: Correlation coefficients between choices in last round (source) and first round (target) by treatment

| | | last (source) | first (target) | last (target) |
|---|---|---|---|---|
| group 1 | N. of 1's | 0 | 1 | 0 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 0 | 1 | 1 |
| | N. of 4's | 0 | 0 | 1 |
| | N. of 5's | 0 | 0 | 4 |
| | N. of 6's | 0 | 1 | 1 |
| | N. of 7's | 7 | 3 | 0 |
| group 2 | N. of 1's | 0 | 2 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 0 | 1 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 7 | 4 | 7 |
| group 3 | N. of 1's | 0 | 0 | 0 |
| | N. of 2's | 1 | 1 | 0 |
| | N. of 3's | 5 | 2 | 7 |
| | N. of 4's | 1 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 1 | 0 |
| | N. of 7's | 0 | 3 | 0 |
| group 4 | N. of 1's | 0 | 1 | 0 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 6 | 0 | 0 |
| | N. of 5's | 1 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 5 | 7 |
| group 5 | N. of 1's | 0 | 1 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 7 | 1 | 6 |
| | N. of 4's | 0 | 2 | 1 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 1 | 0 |
| | N. of 7's | 0 | 2 | 0 |
| group 6 | N. of 1's | 0 | 0 | 0 |
| | N. of 2's | 0 | 2 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 7 | 5 | 7 |

Table 7: Treatment CM-ME, six groups. The table reports the number of players who selected each number 1-7 in the last round of the CM game, and in the first and last rounds of the ME game.

| | | last (source) | first (target) | last (target) |
|---|---|---|---|---|
| group 1 | N. of 1's | 1 | 3 | 0 |
| | N. of 2's | 1 | 0 | 0 |
| | N. of 3's | 0 | 1 | 0 |
| | N. of 4's | 1 | 2 | 2 |
| | N. of 5's | 0 | 0 | 3 |
| | N. of 6's | 4 | 0 | 2 |
| | N. of 7's | 0 | 1 | 0 |
| group 2 | N. of 1's | 0 | 1 | 7 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 1 | 0 |
| | N. of 5's | 7 | 2 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 1 | 0 |
| group 3 | N. of 1's | 0 | 1 | 5 |
| | N. of 2's | 0 | 0 | 1 |
| | N. of 3's | 0 | 1 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 7 | 5 | 1 |
| group 4 | N. of 1's | 0 | 0 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 1 | 0 |
| | N. of 7's | 7 | 6 | 7 |
| group 5 | N. of 1's | 0 | 1 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 2 |
| | N. of 7's | 7 | 6 | 5 |
| group 6 | N. of 1's | 0 | 0 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 7 | 7 | 7 |

Table 8: Treatment IR-ME, six groups. The table reports the number of players who selected each number 1-7 in the last round of the IR game, and in the first and last rounds of the ME game.

| | | last (source) | first (target) | last (target) |
|---|---|---|---|---|
| group 1 | N. of 1's | 5 | 0 | 0 |
| | N. of 2's | 1 | 1 | 0 |
| | N. of 3's | 0 | 2 | 0 |
| | N. of 4's | 0 | 1 | 0 |
| | N. of 5's | 1 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 3 | 7 |
| group 2 | N. of 1's | 4 | 0 | 0 |
| | N. of 2's | 1 | 1 | 0 |
| | N. of 3's | 0 | 1 | 0 |
| | N. of 4's | 2 | 1 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 4 | 7 |
| group 3 | N. of 1's | 7 | 0 | 0 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 0 | 2 | 0 |
| | N. of 4's | 0 | 1 | 0 |
| | N. of 5's | 0 | 0 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 3 | 7 |
| group 4 | N. of 1's | 1 | 0 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 0 | 1 | 0 |
| | N. of 4's | 2 | 1 | 0 |
| | N. of 5's | 1 | 1 | 0 |
| | N. of 6's | 1 | 0 | 7 |
| | N. of 7's | 0 | 4 | 0 |
| group 5 | N. of 1's | 5 | 0 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 1 | 0 | 0 |
| | N. of 4's | 0 | 3 | 0 |
| | N. of 5's | 0 | 1 | 0 |
| | N. of 6's | 1 | 0 | 0 |
| | N. of 7's | 0 | 3 | 7 |

Table 9: Treatment ME-CM, five groups. The table reports the number of players who selected each number 1-7 in the last round of the ME game, and in the first and last rounds of the CM game.

| | | last (source) | first (target) | last (target) |
|---|---|---|---|---|
| group 1 | N. of 1's | 7 | 2 | 0 |
| | N. of 2's | 0 | 1 | 7 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 1 | 0 |
| | N. of 5's | 0 | 1 | 0 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 1 | 0 |
| group 2 | N. of 1's | 0 | 0 | 0 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 2 | 2 | 0 |
| | N. of 4's | 2 | 2 | 0 |
| | N. of 5's | 1 | 1 | 0 |
| | N. of 6's | 0 | 1 | 0 |
| | N. of 7's | 0 | 0 | 7 |
| group 3 | N. of 1's | 5 | 0 | 6 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 0 | 1 | 1 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 1 | 0 | 0 |
| | N. of 6's | 0 | 1 | 0 |
| | N. of 7's | 1 | 4 | 0 |
| group 4 | N. of 1's | 1 | 1 | 0 |
| | N. of 2's | 0 | 0 | 0 |
| | N. of 3's | 0 | 2 | 0 |
| | N. of 4's | 5 | 3 | 0 |
| | N. of 5's | 0 | 0 | 4 |
| | N. of 6's | 1 | 0 | 0 |
| | N. of 7's | 0 | 1 | 3 |
| group 5 | N. of 1's | 5 | 0 | 7 |
| | N. of 2's | 0 | 1 | 0 |
| | N. of 3's | 0 | 2 | 0 |
| | N. of 4's | 0 | 0 | 0 |
| | N. of 5's | 1 | 0 | 0 |
| | N. of 6's | 0 | 1 | 0 |
| | N. of 7's | 1 | 3 | 0 |
| group 6 | N. of 1's | 7 | 0 | 0 |
| | N. of 2's | 0 | 2 | 0 |
| | N. of 3's | 0 | 0 | 0 |
| | N. of 4's | 0 | 2 | 0 |
| | N. of 5's | 0 | 0 | 7 |
| | N. of 6's | 0 | 0 | 0 |
| | N. of 7's | 0 | 3 | 0 |

Table 10: Treatment ME-IR, six groups. The table reports the number of players who selected each number 1-7 in the last round of the ME game, and in the first and last rounds of the IR game.

| | time | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| subject | **cohort 1** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | 3 | 7 | 4 | 5 | 7 | 5 | 4 | 6 | 6 | 7 | 7 | 7 | 7 | 1 | 2 | 4 | 2 | 4 | 7 | 7 | 6 | 5 | 7 | 6 | 5 | 6 | 3 |
| 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 5 | 4 | 4 |
| 3 | 7 | 7 | 3 | 4 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 5 |
| 4 | 3 | 4 | 4 | 4 | 4 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 |
| 5 | 3 | 3 | 3 | 4 | 7 | 6 | 5 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 5 | 5 |
| 6 | 2 | 3 | 4 | *4* | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 5 |
| 7 | 7 | 4 | 3 | 4 | 5 | 5 | 6 | 5 | 6 | 7 | 7 | 7 | 7 | 7 | 6 | 5 | 6 | 7 | 7 | 4 | 7 | 7 | 7 | 6 | 7 | 6 | 6 | 5 |
| | **cohort 2** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 4 | 7 | 4 | 7 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 1 | 2 | 4 | 4 | 4 | 7 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 7 | 7 | 4 | 4 | 4 | 4 | 7 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 7 | 7 | 7 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 4 | 4 | 4 | 4 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 3** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 4 | 7 | 2 | 7 | 2 | 4 | 7 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 3 | 7 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 2 | 1 | 2 | 7 | 7 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 7 | 3 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 4 | 3 | 7 | 4 | 3 | 3 | 3 |
| 4 | 4 | 4 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | 2 | 7 | 3 | 7 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 2 | 3 | 6 | 7 | 4 | 7 | 7 | 7 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | 7 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 7 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 3 | 2 | 3 | 3 | 3 | 7 | 7 | 7 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **cohort 4** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 5 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 5 | 5 | 2 | 5 | 5 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 7 | 7 | 5 | 3 | 3 | 3 | 7 | 4 | 3 | 4 | 5 | 7 | 4 | 4 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 4 | 2 | 4 | 1 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 7 | 7 | 7 | 4 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 4 | 4 | 4 | 3 | 3 | 3 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 4 | 3 | 5 | 2 | 7 | 3 | 4 | 5 | 4 | 5 | 1 | 3 | 4 | 4 | 7 | 4 | 5 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 5** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 4 | 3 | 5 | 6 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 1 | 7 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 7 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 2 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 3 |
| 5 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | 7 | 7 | 7 | 4 | 3 | 7 | 3 | 7 | 4 | 4 | 3 | 7 | 3 | 3 | 7 | 4 | 7 | 7 | 7 | 4 | 4 | 3 | 7 | 7 | 7 | 7 | 7 | 4 |
| 7 | 7 | 5 | 2 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 6 | 7 | 7 | 7 | 7 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 3 | 3 |
| | **cohort 6** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 5 | 5 | 2 | 3 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 7 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 3 | 7 | 5 | 2 | 2 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 1 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 3 | 1 | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 2 | 3 | 6 | 7 | 2 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 3 | 7 |

Individual choices in the CM-ME treatment

| | time | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| **subject** | **cohort 1** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 5 | 2 | 3 | 6 | 4 | 1 | 7 | 5 | 3 | 6 | 2 | 4 | 1 | 4 | 1 | 3 | 6 | 2 | 5 | 6 | 1 | 5 | 4 | 7 | 3 | 7 | 5 |
| 2 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 4 | 1 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 5 | 6 |
| 3 | 7 | 3 | 3 | 3 | 3 | 5 | 2 | 1 | 5 | 5 | 5 | 5 | 6 | 2 | 1 | 4 | 4 | 5 | 2 | 5 | 4 | 6 | 5 | 4 | 7 | 3 | 6 | 5 |
| 4 | 5 | 3 | 3 | 4 | 3 | 3 | 7 | 3 | 4 | 5 | 5 | 5 | 3 | 4 | 3 | 4 | 5 | 3 | 7 | 4 | 5 | 6 | 4 | 4 | 4 | 4 | 3 | 4 |
| 5 | 2 | 5 | 3 | 3 | 5 | 5 | 5 | 5 | 3 | 5 | 5 | 6 | 5 | 6 | 1 | 3 | 3 | 4 | 5 | 5 | 6 | 7 | 6 | 6 | 6 | 6 | 4 | 5 |
| 6 | 4 | 3 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 1 | 2 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 |
| 7 | 3 | 3 | 4 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 6 | 7 | 4 | 4 | 4 | 6 | 7 | 5 | 6 | 6 | 6 | 6 | 7 | 6 | 6 |
| | **cohort 2** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | 4 | 5 | 5 | 5 | 6 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 2 | 5 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 |
| 2 | 3 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| 3 | 4 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 |
| 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 |
| 5 | 7 | 4 | 4 | 7 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| 6 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| 7 | 7 | 7 | 7 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 |
| | **cohort 3** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 3 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 2 | 4 | 5 | 3 | 2 | 3 | 4 | 7 | 4 | 2 | 2 | 2 |
| 2 | 7 | 7 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 5 | 5 | 6 | 7 | 7 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 4 | 7 | 5 | 1 | 1 |
| 4 | 7 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 7 | 3 | 2 | 7 | 3 | 2 | 1 | 7 | 1 |
| 5 | 7 | 7 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 3 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | 3 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 7 | 7 | 7 | 7 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| | **cohort 4** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 7 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 3 | 4 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 7 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 5** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 7 | 7 | 7 | 7 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 7 | 7 | 6 | 7 | 6 | 7 | 5 | 6 | 7 | 7 | 6 | 7 | 6 |
| 2 | 5 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 6 | 6 | 7 | 6 | 6 | 7 | 6 | 6 |
| 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 6** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 7 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 1 | 7 | 7 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 3 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |

Individual choices in the IR-ME treatment

| | time | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| **subject** | **cohort 1** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 6 | 5 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 5 | 6 | 2 | 1 | 1 | 1 | 1 | 1 | 7 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 4 | 5 | 1 | 2 | 7 | 1 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 3 | 1 | 2 | 5 | 1 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 5 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 1 | 4 | 5 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 4 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 2** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | 5 | 5 | 5 | 1 | 3 | 3 | 1 | 1 | 1 | 7 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 3 | 5 | 4 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 1 | 5 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 5 | 6 | 1 | 7 | 4 | 4 | 5 | 2 | 7 | 3 | 4 | 2 | 3 | 4 | 2 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 5 | 3 | 4 | 1 | 5 | 3 | 1 | 2 | 1 | 1 | 1 | 4 | 1 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 7 | 4 | 3 | 1 | 3 | 5 | 1 | 1 | 7 | 7 | 1 | 1 | 7 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 7 | 7 | 3 | 4 | 2 | 3 | 7 | 1 | 5 | 4 | 1 | 7 | 2 | 1 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 7 | 7 | 2 | 3 | 6 | 7 | 5 | 1 | 6 | 5 | 7 | 1 | 1 | 1 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 3** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 7 | 4 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 1 | 2 | 4 | 3 | 4 | 2 | 3 | 5 | 2 | 3 | 1 | 1 | 1 | 1 | 7 | 6 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 7 | 7 | 7 | 7 | 7 | 7 | 4 | 4 | 4 | 3 | 3 | 2 | 1 | 1 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 1 | 4 | 5 | 7 | 2 | 2 | 7 | 7 | 2 | 2 | 2 | 1 | 1 | 1 | 7 | 7 | 7 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 7 | 7 | 7 | 7 | 7 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 4 | 3 | 4 | 3 | 2 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 4** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7 | 7 | 6 | 6 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 7 | 5 | 3 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 2 | 7 | 7 | 7 | 7 | 6 | 6 | 5 | 7 | 5 | 7 | 5 | 3 | 5 | 5 | 7 | 7 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 3 | 3 | 7 | 6 | 6 | 7 | 6 | 7 | 6 | 7 | 6 | 6 | 5 | 7 | 6 | 7 | 7 | 5 | 5 | 5 | 6 | 6 | 5 | 6 | 6 | 6 | 7 | 6 | 6 |
| 4 | 5 | 6 | 7 | 5 | 6 | 6 | 7 | 7 | 6 | 5 | 6 | 6 | 5 | 1 | 5 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 5 | 7 | 6 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 | 6 | 5 | 5 | 5 | 7 | 7 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 6 | 7 | 7 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 4 | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | 4 | 5 | 3 | 4 | 5 | 5 | 6 | 5 | 5 | 4 | 3 | 5 | 4 | 4 | 3 | 5 | 4 | 3 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | **cohort 5** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7 | 7 | 7 | 7 | 7 | 4 | 5 | 5 | 2 | 3 | 2 | 2 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 7 | 4 | 5 | 6 | 5 | 6 | 6 | 5 | 5 | 3 | 3 | 2 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 5 | 2 | 4 | 4 | 3 | 5 | 3 | 2 | 4 | 4 | 3 | 3 | 2 | 1 | 4 | 4 | 2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 3 | 2 | 4 | 3 | 4 | 5 | 4 | 5 | 3 | 3 | 2 | 1 | 2 | 1 | 5 | 5 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 2 | 5 | 7 | 6 | 7 | 4 | 6 | 7 | 2 | 5 | 3 | 7 | 4 | 6 | 4 | 2 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 3 | 3 | 7 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 1 | 4 | 4 | 6 | 5 | 6 | 6 | 5 | 6 | 2 | 2 | 2 | 1 | 1 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |

Individual choices in the ME-CM treatment

| | time | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| **subject** | **cohort 1** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 5 | 4 | 5 | 4 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 7 | 7 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | 3 | 5 | 1 | 4 | 2 | 1 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 4 | 7 | 1 | 3 | 1 | 1 | 2 | 3 | 2 | 2 | 2 |
| 3 | 7 | 1 | 2 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | 4 | 7 | 6 | 4 | 1 | 2 | 3 | 1 | 5 | 3 | 2 | 2 | 4 | 1 | 1 | 7 | 2 | 3 | 4 | 5 | 2 | 1 | 2 | 6 | 2 | 2 | 2 | 2 |
| 5 | 1 | 7 | 3 | 4 | 2 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 6 | 3 | 1 | 1 | 1 | 1 | 7 | 3 | 1 | 7 | 1 | 1 | 1 | 1 | 1 | 5 | 2 | 7 | 7 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| 7 | 6 | 5 | 3 | 3 | 7 | 2 | 2 | 1 | 3 | 4 | 4 | 2 | 1 | 1 | 4 | 7 | 2 | 1 | 2 | 3 | 1 | 2 | 2 | 2 | 7 | 2 | 2 | 2 |
| | **cohort 2** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 |
| 2 | 7 | 1 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 4 | 4 | 5 | 3 | 3 | 5 | 7 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3 | 4 | 5 | 6 | 6 | 6 | 5 | 4 | 4 | 2 | 3 | 7 | 5 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 5 | 6 | 1 | 7 | 5 | 6 | 7 | 6 | 7 | 6 | 5 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 5 | 6 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 3 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6 | 4 | 3 | 6 | 1 | 1 | 4 | 2 | 2 | 1 | 5 | 3 | 2 | 3 | 3 | 2 | 7 | 2 | 3 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 5 | 4 | 5 | 3 | 5 | 5 | 5 | 4 | 3 | 7 | 7 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | **cohort 3** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 7 | 5 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 3 | 3 | 5 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 7 | 7 | 7 | 6 | 1 | 1 | 7 | 3 | 4 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 7 | 3 | 4 | 6 | 1 | 2 | 7 | 5 | 1 | 7 | 7 | 1 | 2 | 3 |
| 4 | 4 | 5 | 2 | 3 | 6 | 2 | 4 | 6 | 2 | 3 | 7 | 1 | 6 | 1 | 6 | 7 | 7 | 4 | 3 | 3 | 4 | 1 | 1 | 1 | 1 | 7 | 1 | 1 |
| 5 | 6 | 2 | 4 | 3 | 5 | 7 | 2 | 3 | 5 | 3 | 4 | 2 | 6 | 5 | 3 | 5 | 2 | 1 | 3 | 4 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| 6 | 7 | 7 | 6 | 6 | 4 | 5 | 3 | 3 | 4 | 2 | 3 | 1 | 1 | 1 | 2 | 7 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | 4 | 5 | 6 | 7 | 7 | 7 | 4 | 7 | 5 | 5 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | **cohort 4** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 1 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 |
| 2 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 3 | 4 | 7 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 5 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 5 |
| 4 | 7 | 5 | 5 | 5 | 7 | 7 | 5 | 6 | 7 | 6 | 7 | 7 | 6 | 1 | 7 | 7 | 5 | 5 | 5 | 3 | 5 | 7 | 7 | 5 | 5 | 7 | 7 | 7 |
| 5 | 4 | 5 | 4 | 5 | 3 | 4 | 6 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 7 |
| 6 | 7 | 3 | 4 | 2 | 6 | 4 | 5 | 3 | 5 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 |
| 7 | 4 | 3 | 7 | 6 | 7 | 3 | 5 | 2 | 5 | 7 | 4 | 4 | 4 | 6 | 3 | 4 | 4 | 5 | 2 | 4 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | **cohort 5** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 4 | 7 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 1 |
| 2 | 1 | 2 | 5 | 1 | 3 | 4 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 5 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 1 | 1 |
| 3 | 1 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 1 | 1 |
| 4 | 3 | 2 | 1 | 4 | 2 | 3 | 1 | 4 | 5 | 1 | 6 | 1 | 1 | 1 | 3 | 2 | 1 | 6 | 2 | 1 | 3 | 4 | 2 | 6 | 1 | 1 | 1 | 1 |
| 5 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 1 | 1 |
| 6 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 7 | 7 | 7 | 2 | 7 | 7 | 7 | 7 | 1 | 1 | 1 | 1 |
| 7 | 6 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | 7 | 3 | 7 | 7 | 7 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | **cohort 6** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 4 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |
| 3 | 7 | 4 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 4 | 5 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 7 | 7 | 7 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| 5 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 |
| 6 | 7 | 7 | 7 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 2 | 3 | 2 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 5 |

Individual choices in the ME-IR treatment