# Avoidance, antipathy, and aggression: A three-wave longitudinal network study on negative networks, status, and heteromisos

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A R T I C L E   I N F O

A B S T R A C T

Our aim is to explain negative networks in Dutch high schools, using three-wave stochastic actor oriented models (SAOMs). We differentiate between avoidance, antipathy, and aggression based on how costly and visible these behaviours are. Our results show that pupils' ethnicity does not explain negative ties. Moreover, we do not find that negative ties form archetypical social hierarchies, formed by networks that are asymmetrical and transitive. Instead, we find positive effects of reciprocity on avoidance, antipathy, and aggression, and we find no effects of transitivity. Rather than allowing themselves to be dominated by their classmates, pupils fight back and reciprocate negative behaviour. We further show that some pupils behave negatively to a lot of their classmates, and that some pupils are treated negatively by many classmates. These results require us to reconsider what status hierarchies look like. Finally, we explore the extent to which the avoidance, antipathy, and aggression networks co-evolve.

## Introduction

This study is concerned with explaining negative ties, using three waves of social network data collected in secondary schools in the Netherlands. There is a growing interest in negative networks. Despite being relatively rare compared to positive ties, negative ties may be more likely to drive attitudes, behaviours, and network dynamics than positive ties (Brass and Labianca, 2006). Only fairly recently have scholars begun to explore how negative networks may differ from positive networks. Based on research on dislike relationships amongst university students, it has been suggested that negative networks generally are less dense, less transitive, and less reciprocal than positive networks (Everett and Borgatti. 2014; Harrigan and Yap, 2017; Yap and Harrigan, 2015).

Notwithstanding the burgeoning empirical research on negative networks, much remains to be learned about the antecedents of negative ties. In addition, previous research has typically not considered how different types of negative ties may differ from one another, and whether the same theoretical mechanisms explain why people dislike, avoid, or assault someone. To tackle this, we study three categories of negative ties within one and the same sample: avoidance, antipathy, and aggression. We argue that these three types of negative ties differ from

one another in how costly and observable they are, with implications for how common, transitive, and reciprocal these negative ties can be expected to be. We subsequently use longitudinal multiplex network data with these three types of networks to test hypotheses, derived from ideas about status and interethnic relations, that are specific to avoidance, antipathy and aggression.

First, status theory is used, in one form or another, in most if not all research on negative networks. Some scholars claim that aggressive behaviour is an effective way to achieve status (Faris and Ennett, 2012; Faris and Felmlee, 2014; Maynard, 1985). Others argue that disliking and avoiding classmates are ways to disassociate oneself from lower status peers (Ball and Newman, 2013; Bond et al., 2014; Bothner et al., 2010; Card and Hodges, 2007). Yet others proposed the far more general idea that all negative behaviour serves to show that one is of higher status than someone else (Harrigan and Yap, 2017; Leskovec et al., 2010; Yap and Harrigan, 2015).

However, it remains unclear whether status theory can explain all forms of negative relationships amongst adolescents equally well. For one, dislike and avoidance are often found to be reciprocated (Berger and Dijkstra, 2013; Boda and Néray, 2015; Ellwardt et al., 2012; Fujimoto et al., 2017; Huitsing et al., 2012; Pál et al., 2016; Rambaran et al., 2015). In fact, several studies specifically look at mutual, or

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reciprocated, antipathies (Abecassis et al., 2002; Card, 2007, 2010; Card and Hodges, 2007; Erath et al., 2009; Murray-Close and Crick, 2006; Witkow et al., 2005). Furthermore, dislike and avoidance are sometimes found not to be transitive (Harrigan and Yap, 2017). Both findings can be seen as contradictory to an informal status hierarchy (Everett and Krackhardt, 2011; Krackhardt, 1994). Using our typology of avoidance, antipathy, and aggression we aim to offer an explanation for the inconsistent results of recent empirical studies on negative networks and status.

Our second contribution to the literature on negative networks is to have a closer look at the role of the migration background of pupils. Ethnicity is a particularly important sorting tool in classrooms, influencing who becomes friends with whom (McPherson et al., 2001), and possibly also who dislikes, avoids, and victimizes whom (Tolsma et al., 2013; Verkuyten, 2003). Ethnicity is particularly relevant for high school pupils as their ethnic identity starts to take shape during adolescence (Phinney et al., 1990), and the school setting offers many opportunities for interethnic relationships to form (Wölfer et al., 2018). The latter is also apparent in research showing that interethnic friendships are more likely to be formed in early adolescence than at other ages, like adulthood (Wölfer et al., 2016).

We consider the influence of migration background on avoidance, antipathy, and aggression amongst adolescents in two ways. First, pupils with a migration background tend to have a lower status when they are in the minority (Tolsma et al., 2013). Following the logic that pupils send negative ties to classmates of lower status, this could imply that pupils with a migration background are more likely to be avoided, disliked, and assaulted than their native classmates (Boda and Néray, 2015; Rubineau et al., 2019). Second, by applying the well-known principle of homophily to negative networks, we test whether negative ties are governed by heteromisos, or a dislike for dissimilar people, and are thus more likely to exist between pupils who are not alike in terms of migration background.[1] Following the suggestions from previous research (Hagendoorn, 1995) we further examine whether pupils with a non-western migration background are considered more dissimilar from natives than pupils with a western-migration background, and are therefore avoided, disliked, and victimized more often.

All in all, we seek to answer the following main research question: Can status theory and the migration background of pupils explain avoidance, antipathy, and aggression amongst adolescents?

In order to answer this question we make use of a unique dataset collected in two Dutch high schools in the schoolyear 2017–2018, amongst a total of 227 first year pupils. Three waves of data were collected: in the first month of the schoolyear (September), right after the Christmas break, and in the last month before the summer holidays (June). Our sample consists of first year pupils who typically do not know one another before entering high school, and we control for pupils who were already acquainted before becoming classmates.

We used RSiena to perform meta-analyses on the results obtained from the individual classrooms. Doing so allowed us to study network dynamics as they unfold longitudinally, while controlling for any heterogeneity in effects between classes. In order to capture different sides of the same types of negative relationships, we measured several types of negative ties that we subsequently collapsed into the three overarching negative networks of avoidance, antipathy, and aggression. This was done in accordance with the steps of dimension reduction recently proposed by Vörös and Snijders (2017).

Finally, it is important to note that the interplay between avoidance, antipathy, and aggression on the one hand, and friendship networks on

the other hand is not within the scope of this paper. Considering how little is currently known about negative networks, we think there is a lot to be gained from solely focusing on negative networks. Doing so will help in gaining a better understanding of the antecedents of negative networks, and the distinction and overlap between different negative networks. A better apprehension of negative networks may even prove to be a prerequisite for more specific expectations about the way negative and positive networks may influence one another. That said, in the discussion of the current paper we do reflect on ways in which the omission of friendships may have influenced our conclusions.

## Theory

The theory section is structured as follows. First, status theory will be described as an explanation for negative behaviour between classmates. Particular attention will be devoted to the concepts of reciprocity and transitivity. Subsequently, a typology of negative ties will be outlined, which distinguishes between avoidance, antipathy, and aggression in terms of cost and visibility. This typology is then used, in combination with status theory, to derive specific hypotheses about reciprocity and transitivity for the three types of negative ties. Afterwards, the influence of pupils' migration background on negative relationships will be considered.

### *Status hierarchies: aggressive dominance and peer rejection*

Status has long been recognized as an important concept in sociology, particularly for adolescents in high schools (Coleman, 1961; Faris, 2012), and can be be broadly defined as an individual's position in the social hierarchy of a group, based on superior-inferior relationships (Gould, 2002). The hierarchical ranking of people is described as a universal feature of social groups (Gould, 2002), and already comes naturally to young children (Callan, 1970). Status differences between pupils serve to add stability to their relationships, and being of high status comes with its own set of rewards, like scarce resources, disproportionate influence over group decisions, attention and approval of peers, and self-esteem (Savin-Williams, 1979).

One way in which pupils can climb the informal social hierarchy is to be aggressive towards others, thereby showing they are superior (Cheng et al., 2013). Congruently, aggression in adolescents is often viewed as instrumental for status attainment (Faris and Ennett, 2012; Faris, 2012; Maynard, 1985; Pellegrini and Long, 2002; Veenstra et al., 2007; Sijtsema et al., 2009). In short, aggression may serve to secure adolescents' position in a social dominance hierarchy.

Status has also been used to explain why pupils avoid and dislike one another. Based on research on preferential attachment (Ball and Newman, 2013), status leakage (Bothner et al., 2010), and peer rejection (Card and Hodges, 2007; Bond et al., 2014), it can be argued that people prefer to be associated with higher-status peers. By disliking certain classmates, pupils may try to establish or maintain one's own status. They avoid or reject lower-status peers in order to protect one's own status against the stain of being associated with lower-status peers. On the other hand, it has also been suggested that popular pupils are not universally liked either. High-status classmates may even be disliked for being popular and dominant (Parkhurst and Hopmeyer, 1998). Recent research suggests that dislike can also arise when a pupil looks down upon a classmate while they think that very classmate is well liked by many other pupils in the class (Pál et al., 2016). This discrepancy may result in feelings of frustration, which may then lead to antipathy. That said, the strongest and most consistent empirical support is found for the idea that pupils dislike classmates that they look down upon themselves, out of disdain, or classmates that are looked down upon by their peers, out of conformity (Pál et al., 2016). In fact, low-status pupils tend to be disliked disproportionally more often than their high-status peers (Dijkstra et al., 2012). We therefore hypothesize that dislike and avoidance are more likely to "travel down the hierarchy", from

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[1] We are aware that the term heterophobia is more commonly used to describe the tendency, opposite to homophily, to dislike people who are dissimilar. We have decided to use heteromisos instead because we feel that the Greek word for hate (*misos*) is more in line with aggression, dislike, and avoidance than the more commonly used concept of fear (*phobia*).

high-status pupils to low-status pupils (Rubineau et al., 2019; Berger and Dijkstra, 2013; Daniel et al., 2016).

Finally, informal social hierarchies can be operationalized by two network characteristics: transitivity and reciprocity. First, an archetypical social hierarchy, or "pecking order" (Eder, 1985), is asymmetrical (not reciprocated): if pupil A is superior to pupil B, B cannot also be superior to A. Second, an archetypical social hierarchy is transitive: if A is superior to B, and B is superior to C, then A must also be superior to C (Martin, 2009).

Therefore, if aggression, avoidance, and antipathy all serve to achieve and maintain social superiority over other pupils in the classroom, then we can expect these three negative networks to be transitive but not reciprocated (Krackhardt, 1994).

*A typology of negative ties: avoidance, antipathy, and aggression*

So far we have argued that avoidance, antipathy, and aggression may all be governed by struggles between classmates over status positions. Yet they may also differ from one another in ways that are important for reciprocity and transitivity. In order to structure our expectations regarding the distinct types of negative ties, we will now sketch out a typology of negative networks. Besides appreciating that, in our study, aggression and avoidance are forms of active behaviour while antipathy is more of a latent mental state, we mostly distinguish between avoidance, antipathy, and aggression on the basis of two characteristics: cost and visibility. We will then use this typology, in combination with status theory, to derive hypotheses for the three types of ties.

First, we argue that aggression is more costly than both antipathy and avoidance. Aggressive behaviour is particularly costly because it is non-normative behaviour (Ellwardt et al., 2012; Rose et al., 2004). The perpetrator can thus be sanctioned by his or her classmates for being aggressive. Further, the aggressor always runs the risk of being beaten at his or her own game. Even the strongest pupil might be physically hurt, a cost in and of itself, and subsequently loose face in front of the other pupils in the class as well (Gambetta, 2009).

Antipathy, or the mental state of disliking someone, can be seen as less costly than aggression, if only for the simple reason that, unlike aggressive behaviour, antipathy does not imply direct or physical harm for the actor. Similarly, avoiding a classmate excludes – almost by definition – the possibility of being physically harmed by that classmate. For these reasons we argue that avoidance and antipathy are less costly forms of negative behaviour than aggression.

The difference between avoidance and antipathy in terms of costs are less immediately clear. Disliking someone that you have to interact with on a day-to-day basis, like a classmate, can be psychologically stressful (Card, 2007). Antipathies between pupils have been shown to be related to several indicators of poor psychological well-being (Abecassis et al., 2002; Witkow et al., 2005). In contrast, avoidance could be a sign of indifference, and could therefore be less psychologically demanding than disliking someone. At the same time however, actively avoiding a classmate could also be indicative of psychological stress, as this might be the very reason why a pupil would prefer not to interact with a specific classmate. We therefore do not formulate a strict expectation regarding the difference in costliness of avoidance and antipathy. Instead, the comparison between the costs involved in avoiding and disliking a classmate is more exploratory in nature. From a rational choice perspective costly behaviour can be expected to be less common, as people tend to prefer options that are less costly (Smith, 1982). Given our ranking of the three negative ties, we would therefore anticipate aggressive behaviour to be least common, followed by antipathy and avoidance. In our dataset, this indeed holds true (see the results section for more information).

All in all, we have argued that i) costly behaviour is less common and reciprocated less often, and ii) that aggression is most costly, followed by antipathy and avoidance. Combining these two arguments we can expect the following:

**Hypothesis 1**. The negative effect of reciprocity is stronger for aggression than for antipathy and avoidance.

Second, it can be argued that aggression is more visible than both antipathy and avoidance, and that avoidance is in turn more visible than antipathy. By visibility we mean the extent to which not only ego (*i*) is aware of the negative tie, but the alter (*j*); and a third person (*h*) are as well.

For one, aggressive behaviour is intended to inflict damage, be it physical or psychological, upon another person. Consequently, the victim will know when someone is being aggressive towards him or her. Further, aggression is a communicative act that can be used to convey, not only to the victim but also the wider audience, that the aggressor is willing to stand up for him or herself (Gambetta, 2009). Aggression is thus more effective if observed by third parties as well.

In contrast, avoidance and antipathy are less readily observed by others. For one, it is very well possible to avoid or dislike someone without communicating this overtly to that person, or to a third party (Rambaran et al., 2015). If pupil A were to dislike and actively avoid pupil B, it becomes difficult for A to know what other pupils B dislikes and avoids. In fact, the lack of visibility in avoidance and dislike relationships is one of the things that has been used to distinguish negative networks from positive networks. For instance, Everett and Borgatti (2014) doubted that information would diffuse in dislike networks as it does in friendship networks, and did not expect "things to flow along paths of length greater than one" (p. 112). This is also the explanation Harrigan and Yap (2017) give for the absence of triadic closure in their avoidance and dislike networks amongst university students.

Although the distinction between aggression on the one hand and avoidance and antipathy on the other is clearer, we believe there is reason to expect that avoidance is more visible for other pupils than antipathy. Dislike, as defined in the current study, is a mental state while avoidance is active behaviour. We assume that behaviour is more readily observed than an affective state of mind.

Finally, we argue that less visible negative ties hamper information flow, thereby making transitivity less likely (Everett and Borgatti, 2014; Harrigan and Yap, 2017). Transitivity, in turn, can be seen as a sign of an informal social hierarchy (Krackhardt, 1994). Further, since status is inherently social, more visible negative relationships are arguably more effective at achieving or maintaining status, as other pupils in the classroom need to 'confirm' these superior-inferior relationships.

In sum, we have argued that i) visible behaviour is more likely to be transitive, and ii) that aggression is most visible, followed by avoidance, and then antipathy. Tying these two arguments together, we can expect transitivity to be least likely for antipathy, then avoidance, then aggression.

**Hypothesis 2**. The positive effect of transitivity is strongest in aggression, then in avoidance, and then in antipathy.

*Migration background: indicating low status and dissimilarity*

In this section we consider whether negative relationships between classmates might also be governed by characteristics of the pupils involved. In particular, we will look at the influence of migration background in two ways: as an indication of low status, and as an important sign of dissimilarity, fueling heteromisos.

First, everyone – including other pupils with a migration background – might avoid, dislike, and victimize classmates with a migration background. Pupils with a migration background might have a lower status position as they come into the school, when they are in the minority.

Their status in the classroom does not likely exist in a vacuum but can be expected to be influenced by what occurs outside of the classroom, and outside of the school. In the Netherlands, people with a migration background are more likely to be discriminated against and looked down upon (Kleinpenning and Hagendoorn, 1993). Migrant adolescents

might therefore start off with a status disadvantage as they enter their high school (Verkuyten and Thijs, 2002). If it is true that all negative behavior is directed at low-status peers, either to assert dominance or to protect against status leakage, then migrant pupils may attract more negative behavior than native pupils.

This idea is supported by two recent empirical findings. First, Boda and Néray (2015) show that Roma minority pupils dislike one another more often than pupils who belong to the ethnic majority. This can be interpreted as ethnic minority pupils trying to distance themselves from one another in order to prevent being tainted by associating with low-status, migrant peers. Second, Boda and Néray (2015) also found that ethnic majority pupils are likely to dislike Roma minority pupils, while the opposite is not true. This suggests that the higher status kids reject the lower status kids (Rubineau et al., 2019), and is in line with research by Fiske (2011) indicating that privileged groups respond to stigmatized groups with pity and distancing. We therefore formulate the following hypothesis:

**Hypothesis 3.** (a) Aggression, (b) antipathy, and (c) avoidance are more likely to be directed at pupils with a migration background than at native pupils.

Yet migration background can also play a different role in negative relationships amongst classmates. The tendency for homophily – or the like of similar people – is well documented, and ethnicity is particularly important in informing whether people are similar and therefore become friends with one another (McPherson et al., 2001). Applied to negative networks, we will test whether there is also a tendency for heteromisos and consider whether dissimilarity in terms of ethnicity breeds dislike or even animosity.

The idea that negative behaviour is more likely to occur between two pupils from a different ethnic group than between two co-ethnic pupils can be expected based on research on prejudice amongst adolescents (Tolsma et al., 2013). For example, previous research on Dutch schools suggests that one in three ethnic minority children experienced racist name-calling or were excluded from play because of their ethnic background (Verkuyten and Thijs, 2002). Prejudice thus appears to be relatively common amongst adolescents in the Netherlands. This may result in adolescents behaving more negatively towards peers of a different ethnicity than towards same-ethnicity peers (Schütz and Siz, 1996).

Furthermore, the idea that negative behaviour could more often be interethnic than intraethnic can also be derived from social identity theory (Tajfel and Turner, 1979). This theory postulates that the groups to which people belong form a source of pride and self-esteem. One way in which people maintain the link between group membership and this sense of pride is by clearly distinguishing themselves from other groups and debasing them (Wittek et al., 2019). It has been argued that this strategy should also be observable in the prevalence of negative interethnic contact over negative intraethnic contact (Boda and Néray, 2015). We therefore expect the following:

**Hypothesis 4.** (a) Aggression, (b) antipathy, and (c) avoidance are more likely between a native pupil and a pupil with a migration background, than between two native pupils or two pupils with a migration background.

We do not assume there will be differences between the three negative ties when it comes to the influence of the migration background of the pupils (Hypotheses 3 and 4), because of two reasons. First, if migration background is an indicator of low status, and aggression, avoidance, and antipathy are all ways to gain or maintain status, then they can all be expected to be directed at migrant pupils more often than at native pupils. Second, if migration background is a sign of dissimilarity, and it is dissimilarity that results in avoidance, dislike, and aggression, then heteromisos can be expected in all three types of negative relationships.

## Data

For this study, we have made use of a unique dataset collected in the schoolyear 2017-2018. Two Dutch high schools participated in the study. Only the first year pupils were sampled. Most of them were not acquainted before entering high school, and we control for pupils who did know each other from before. It is therefore possible to study the negative networks amongst these pupils as they take shape. Three waves of data were collected: in the first month of the schoolyear (September), right after the Christmas break, and in the last month before the summer holidays (June). For each wave, the pupils filled out an online survey for the duration of about 45 min (one lesson) at the end of their regular school day. All pupils were given their own login name and password. A team of researchers visited the schools on the day of the data collection to administer and explain the surveys, and make sure everyone could login.

The total number of first-year pupils enrolled in the two schools between September 2017 and July 2018 was 233, spread out over nine classes. In the case of two of the pupils consent was withdrawn. They did not participate in the study and could not be nominated in the sociometric questions by their classmates. Three other pupils joined the high schools later on in the year, and could only be nominated by their classmates in the third wave. They are therefore excluded from the analyses. Ultimately, 228 first-year pupils participated in the surveys. They were 12–13 years old and 43.0 % of them was a girl.

Table 1 further reports per school and for each wave the number of pupils that could have filled out the survey, the number that actually did, and the percentage of pupils who were absent at the time of data collection. There was some attrition, as the percentage of absentees increased over the waves. The highest percentage of missing pupils was 16.2 for the overall sample, and 23.5 when looking at the two schools separately. Although this amount of missingness warrants some caution, it has been deemed manageable in network analyses using RSiena (Krause et al., 2018).

### Measures

#### Dependent variables

The negative networks were measured with peer nomination questions. For each nomination question, the pupils were presented with a roster with the names of all their classmates. They could nominate as many classmates as they liked.

All in all, six peer nomination questions were asked to measure three types of negative social relations: antipathy, avoidance, and aggression (see Table 2 for the labels, phrasing, and expected categorization of the network items). We thus measured the overarching negative relationships with more than one item, in order to capture different sides of the relationships and construct more valid measures (Vörös and Snijders, 2017). For example, both kicking and insulting a classmate can be thought of as aggressive behaviour. By asking about both verbal and physical violence, we can get a better and more layered measure of aggression.

In order to test whether the six nomination questions could be classified in line with our typology of avoidance, antipathy, and

**Table 1**
Absolute and actual sample sizes, and missings per wave, per school.

| | Sample | Wave 1 | | | Wave 2 | | | Wave 3 | | |
| | | N | Missing (%) | | N | Missing (%) | | N | Missing (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| School 01 | 142 | 133 | 9 (6.3) | | 122 | 20 (14.1) | | 115 | 27 (23.5) | |
| School 02 | 86 | 84 | 2 (2.3) | | 77 | 9 (10.5) | | 76 | 10 (11.6) | |
| Total | 228 | 217 | 11 (4.8) | | 199 | 29 (12.7) | | 191 | 37 (16.2) | |

**Table 2**
The labels, phrasing, and expected categorization of the nomination items.

| Label | Nomination question | Categorization |
|---|---|---|
| Dislike | Which of your classmates do you dislike? | Antipathy |
| Avoid lunch | Which of your classmates do you avoid so they don't sit next you during lunch? | Avoidance |
| Avoid project | Which of your classmates do you avoid working with on a school project? | Avoidance |
| Verbal aggression | Which classmates have insulted you, yelled at you, called you names, or insulted you? | Aggression |
| Physical aggression | Which classmates have hit, kicked, or pushed you? | Aggression |
| Bullying | Which classmates bully you? | Aggression |

aggression, we followed the steps of dimension reduction proposed by Vörös and Snijders (2017).

First, using Jaccard indices we measured how much overlap there was between the six network items, in each wave and each class separately, and using Kendall's W we examined how consistent the pairwise similarities were across the nine classes (Jaccard, 1908; Legendre, 2005).[2] From these statistics, reported in Table 3, we can conclude that the two avoidance ties show most overlap with one another. Antipathy is more similar to the two avoidance items than the three indicators of aggressive behaviour. Finally, the three items measuring aggression show more similarities with one another, than with any of the other items. Roughly the same classification emerges in all three waves and nine classes.

This typology was further confirmed by the Ward hierarchical clustering, used to explore the cluster structures of the network items. Fig. 1 shows the global cluster structure obtained from the mean similarity matrices. The two avoidance items cluster together, and the three items measuring bullying and verbal and physical aggression cluster together. Again, antipathy is distinct from both the avoidance and the aggression

**Table 3**
Jaccard indices, averaged across the nine classrooms, and Kendall's W for each wave separately.

| | | Jaccard Index | | | | | Kendall's W |
|---|---|---|---|---|---|---|---|
| | | 1. | 2. | 3. | 4. | 5. | |
| **Wave 1** | | | | | | | |
| 1. | Dislike | / | | | | | 0.9 |
| 2. | Avoid lunch | 0.35 | / | | | | 0.9 |
| 3. | Avoid project | 0.35 | 0.38 | / | | | 0.9 |
| 4. | Verbal aggression | 0.09 | 0.06 | 0.05 | / | | 0.6 |
| 5. | Physical aggression | 0.03 | 0.05 | 0.03 | 0.09 | / | 0.5 |
| 6. | Bullying | 0.02 | 0.01 | 0.01 | 0.10 | 0.04 | 0.8 |
| **Wave 2** | | | | | | | |
| 1. | Dislike | / | | | | | 0.9 |
| 2. | Avoid lunch | 0.37 | / | | | | 0.9 |
| 3. | Avoid project | 0.39 | 0.48 | / | | | 0.8 |
| 4. | Verbal aggression | 0.14 | 0.11 | 0.09 | / | | 0.5 |
| 5. | Physical aggression | 0.08 | 0.06 | 0.06 | 0.25 | / | 0.7 |
| 6. | Bullying | 0.07 | 0.05 | 0.04 | 0.16 | 0.09 | 0.7 |
| **Wave 3** | | | | | | | |
| 1. | Dislike | / | | | | | 0.8 |
| 2. | Avoid lunch | 0.37 | / | | | | 0.9 |
| 3. | Avoid project | 0.32 | 0.43 | / | | | 0.9 |
| 4. | Verbal aggression | 0.13 | 0.12 | 0.13 | / | | 0.3 |
| 5. | Physical aggression | 0.09 | 0.06 | 0.07 | 0.18 | / | 0.4 |
| 6. | Bullying | 0.06 | 0.04 | 0.06 | 0.16 | 0.09 | 0.6 |

items, although it clusters more with the former than with the latter. Based on the Rand Indices (Rand, 1971) reported in Fig. 2 for the three waves separately, it can generally be said that the global cluster structure would be a good fit to the individual classrooms. In most classes and waves, at least 87 percent of the pairs of network items are classified in the same way as in the global cluster structure. The second wave measured in class 4 shows the least similarity (53 %) with the overall structure than the other class-wave measures, but is still acceptable (Vörös and Snijders, 2017).

Based on these statistics, we concluded that we could construct three composite network measures out of the six items, in line with the categorization outlined in Table 1. Antipathy was measured with one item, avoidance with two, and aggression with three. The latter two composite networks were constructed by collapsing the separate items into one adjacency matrix, where a value of 1 implies that a classmate was nominated in any of the questions. Finally, for aggression the adjacency matrix was transposed (rows and columns were switched), so the aggressor became the sender of the tie. This was done because this is more in line with the way the other two negative networks were operationalized, where the sender of the tie is also the actor, or the pupil 'doing' the avoiding and disliking. We initially measured aggressive behaviour as perceived by the victim, as the aggressor might not be willing to admit he or she has been aggressive towards someone.

*Predictor variables*

*Reciprocity* was included in the models in order to test Hypothesis 1. Fig. 3 depicts the configuration of this effect which, in short, measures the likelihood that pupil $i$ will nominate pupil $j$, if pupil $j$ has nominated pupil $i$.

*Transitivity* was operationalized with the gwespFF effect (see Fig. 3), as this best matches the archetypical dominance hierarchy described in the theory section. This network effect indicates the likelihood that pupil $i$ will nominate pupil $j$, if pupil $i$ has nominated a third pupil $h$ who has in turn nominated pupil $j$.

*Migration background* was constructed based on the self-reported country of birth of the pupils' parents. We used the definitions of Statistics Netherlands to define migration background. First, pupils were considered to be native Dutch if both their parents were born in the Netherlands, irrespective of where the pupils were born. We also considered pupils to be native Dutch if one of their parents was born in the Netherlands and the country of birth of the other parent was not reported. All other pupils were considered non-native. Further, and following previous research on migration background in Dutch schools (Geerlings et al., 2018), if a pupil only had one non-Dutch parent we used that parent's country of birth as a more fine-grained ethnic background for the pupil. If both parents were born outside of the Netherlands but in different countries, the mother's country of birth was used. Ultimately, this resulted in 26 different ethnic backgrounds, including native Dutch. For the main analyses, the ethnic backgrounds were subsequently collapsed into one binary variable which distinguished between natives and non-natives. In addition, we collapsed the ethnic backgrounds into three categories: native, non-native with a western migration background, and non-native with a non-western migration background. This was done to explore the possibility that pupils with a non-western western migration background are more distant from natives than non-native pupils with a western migration background (Hagendoorn, 1995). Table A1 in the online supplement shows the full list of ethnic backgrounds as well as the way we categorized them. The ethnic composition of all the classrooms can be found in Table A2 in the online supplement.

*Control variables*

*Known prior* was used as a dyadic covariate and controlled for in all the analyses to take prior and unobserved relationships between the pupils into account (t-1), and was measured with a peer nomination question: 'Which classmates did you know before coming to this
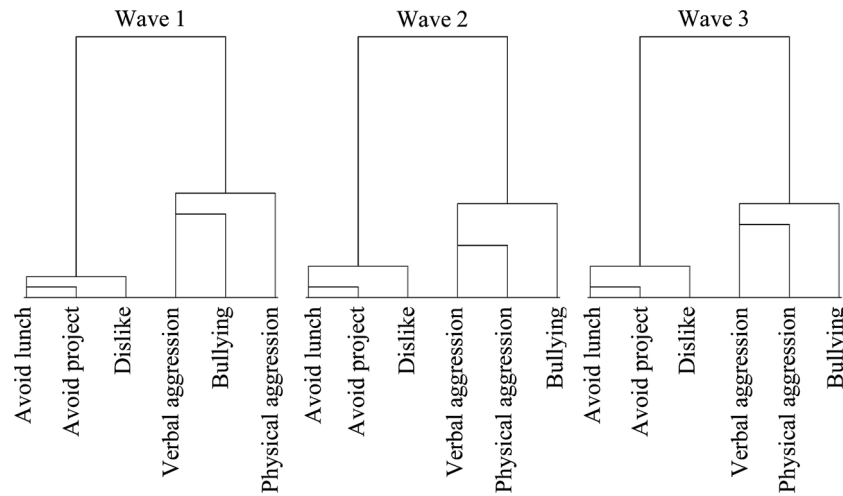
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[2] Jaccard indices for both periods (t1>t2 and t2>t3) for all the six network ties as well as the collapsed networks can be found in Table A9 in the online supplementary material.

**Fig. 1.** Cluster dendrograms from the average similarities in all three waves based on the Ward hierarchical clustering.
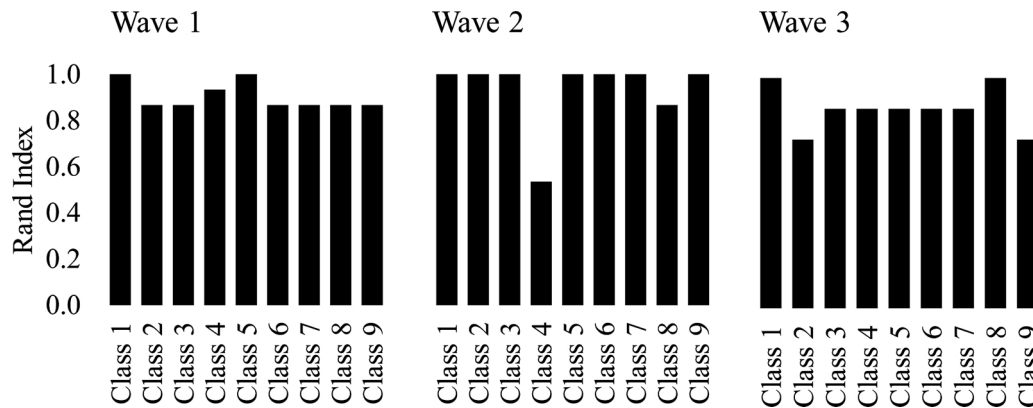


**Fig. 2.** Comparison of class-level cluster structures to the global solution in all three waves. The Rand Index quantifies the percentage of pairs of network items that are classified in the same way in specific classes as in the global cluster structure depicted in Fig. 1.
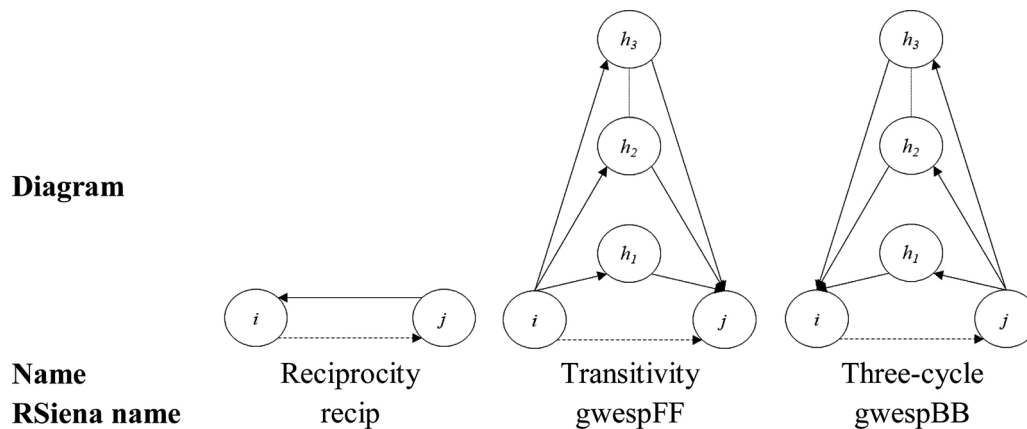


**Fig. 3.** Diagrams, names, and RSiena names of the three network effects included in the models.

school?'. Dyad, ego, and alter effects of *gender* (boy = 1) were controlled for in all the analyses, as gender has been shown to be particularly relevant for aggression and status amongst adolescents (Faris, 2012). Further, the ego effect of migration background was included in all the models. Finally, we controlled for three-cycles, specifically the inverse configuration of the transitivity effect described above (gwespBB in RSiena; see Fig. 3), as well as for three degree-related effects: indegree popularity (inPop), outdegree popularity (outPop), and outdegree

activity (outAct). These additional network effects were included in the model to get a better fitting triad census in the stochastic actor oriented models.

*Analysis*

RSiena (version 1.2–16) was used for all the analyses, which were performed in the nine classes individually, for each of the three negative

networks separately. SienaTimeTest was used to examine heterogeneity within classes across the two periods (between wave 1 and wave 2; and between wave 2 and wave 3). Whenever necessary, such heterogeneity was taken into account by including interactions between the specific effect and a dummy distinguishing between the two time periods. All 27 models (three negative networks * nine classes) were finetuned until the overall test of time heterogeneity was not significant ($p > .05$), the overall maximum convergence ratio was at least below 0.25, and the *t*-ratios of all individual effects were below 0.1 (Ripley et al., 2019).

Subsequently, the results from these models were combined in a meta-analysis (siena08). This approach was chosen to control for heterogeneity in effects between the different classes. We present the results from the iterative weighted least squares method (IWLS hereafter; Snijders and Baerveldt, 2003) to investigate the average effects of the parameters across the classes. Since our data only contains nine classes and thus consists of a rather small number of random samples to assume to represent a population of freshmen classes in Dutch secondary schools, we also report results from the Fisher's combination of *p*-values (Fisher, 1932). The null hypothesis is that no effect is found in any of the classes. The alternative hypothesis is that an effect is found in *at least one* of the classes (Snijders and Bosker, 2012, p. 36). The Fisher's method can therefore be seen as a double test which detects whether a parameter is positive in any of the classes and whether a parameter is negative in any of the classes (Ripley et al., 2019). Finally, we used independent sample t-tests in order to statistically compare the effects of reciprocity and transitivity across the three negative networks, necessary for testing Hypotheses 1 and 2 (see RSiena manual section 8.5, Ripley et al., 2019).

## Results

### Descriptive results

Table 4 reports the density and average degrees of the avoidance, antipathy, and aggression networks, averaged across the n7ine classes in each wave separately. First, it is worth noting that in every wave the avoidance network was most dense, followed by antipathy and then aggression. This is congruent with the idea that costly behaviour is less common (Smith, 1982), and our typology with aggressive behaviour being most costly, followed by antipathy and avoidance. Throughout the schoolyear pupils were, on average, aggressive towards 1.5 classmates, antipathic towards 2 classmates, and actively avoided 5 classmates.

Table 4 also lists the density and degrees, averaged across the nine classes, of the networks indicating which of the pupils knew their classmates before entering their new high school. At the beginning of their first schoolyear pupils already knew, on average, 4.3 of their classmates (*s.d.* = 2.9). This was likely because in the Netherlands it is not uncommon for children who went to the same primary school to then go to the same secondary school as well.

Finally, a total of 149 (65.4 %) pupils were native Dutch and 74 (32.5 %) pupils were non-native. Of the non-native pupils, 54 (73.0 %) had a non-western migration background (see Table A2 in the online supplementary material).

**Table 4**
Density and degrees for the avoidance, antipathy, and aggression networks, averaged across the nine classes, in each wave separately.

| | | Wave 1 | | Wave 2 | | Wave 3 | |
|---|---|---|---|---|---|---|---|
| | | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| Avoidance | Density | 0.198 | 0.061 | 0.240 | 0.115 | 0.235 | 0.156 |
| | Degree | 4.760 | 1.115 | 5.430 | 2.028 | 5.229 | 2.881 |
| Antipathy | Density | 0.071 | 0.020 | 0.105 | 0.062 | 0.090 | 0.067 |
| | Degree | 1.680 | 0.425 | 2.409 | 1.307 | 2.005 | 1.253 |
| Aggression | Density | 0.048 | 0.028 | 0.084 | 0.044 | 0.075 | 1.714 |
| | Degree | 1.096 | 0.546 | 1.916 | 0.920 | 0.065 | 1.171 |
| Known prior | Density | 0.091 | 0.053 | | | | |
| | Degree | 4.265 | 2.904 | | | | |

### Explanatory results

The results from the meta-analyses, based on both the IWLS and Fisher's methods, are presented in Tables 5, 6 and 7, for avoidance, antipathy, and aggression respectively.

### Status hierarchies

First of all, we found a positive effect of reciprocity in all three negative networks. Expressed in terms of odds ratios, calculated based on the IWLS estimated mean parameters: If pupil *j* avoided, disliked, and victimized pupil *i*, pupil *i* was, respectively, $\exp(0.616) = 1.85$, $\exp(0.953) = 2.59$, and $\exp(1.341) = 3.82$ times more likely to avoid, dislike, and victimize pupil *j* in return. This is in contrast to a archetypical social hierarchy, which is defined as asymmetrical, and thus not reciprocated (Martin, 2009). Based on the idea that negative networks serve to ascertain dominance and status, we argued that if pupil A was superior to pupil B, exemplified by negative behaviour, pupil B could not be superior to pupil A. We therefore expected a negative effect of reciprocity on avoidance, antipathy, and aggression. Evidently, this was not supported by our results.

Further, in Hypothesis 1 we expected the negative effect of reciprocity to be stronger for aggression than for antipathy and avoidance. Our results suggest the exact opposite ranking: the positive effect of reciprocity was smallest for avoidance, then antipathy, and then aggression. However, only the difference between the effects of reciprocity on aggression (M = 1.341, s.e. = 0.249) and on avoidance (M = 0.616, s.e. = 0.155) was statistically different from zero, t (15) = 2.472, p < .01.

Second, transitivity did not have an effect on avoidance, antipathy, or aggression. Assuming that disliking, avoiding, and victimizing someone shows superiority, these findings do not support the idea that if pupil *i* is superior to pupil *h*, and *h* is in turn superior to pupil *j*, pupil *i* is more likely to be superior to pupil *j* as well. Furthermore, since transitivity had no effect on any of the three negative networks, Hypothesis 2 was also refuted. The positive effect of transitivity was not stronger for aggression than for avoidance or antipathy. This is not in line with our ranking based on how visible the three types of negative behaviour are, with aggression being the most noticeable for the alter as well as other pupils in the classroom, and antipathy being the least noticeable.

### Migration background

Third, in none of the negative networks did we find alter effects of migration background.[3] Out of step with Hypothesis 3, non-native pupils were not more likely to be avoided, disliked, or victimized than their native classmates. Previous studies suggest that non-native pupils with a non-western migration background are more distant from natives than non-native pupils with a western migration background, and are more often discriminated against in the Netherlands (Hagendoorn, 1995). We therefore also performed the analyses while distinguishing between natives, western non-natives, and non-western non-natives (see Table A3, A4, and A5 in the online supplementary material). The results of these additional analyses show that neither pupils with a western nor pupils with a non-western migration background were more likely to be avoided, disliked, or victimized than native pupils in their classes.

Finally, we did not find any dyadic effects of migration background.

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[3] Because the alter, ego, and same parameters can sometimes be difficult to interpret in unison, we also tested the alter effect of migration background on the negative networks without including the ego and same effects of migration background in the models. The results of these additional analyses also do not show an alter effect of migration background on any of the negative networks. The results of these models are reported Tables A6, A7, and A8 in the online supplementary material.

**Table 5**

Avoidance. Results from the two meta-analyses: iterative weighted least squares method (IWLS) and Fisher's tests.

| | IWLS | | | Fisher's positive test | | | Fisher's negative test | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Mean coefficient* | *s.e.* | *p* (2-sided) | $X^2$ | d.f. | *p* (1-sided) | $X^2$ | d.f. | *p* (1-sided) |
| Density | −2.329 | 0.448 | 0.001 | 2.960 | 18 | 1.000 | 136.092 | 18 | <.001 |
| Reciprocity | 0.616 | 0.155 | 0.004 | 42.566 | 18 | <.001 | 5.147 | 18 | 0.999 |
| Transitivity | −0.130 | 0.297 | 0.673 | 13.728 | 18 | 0.747 | 24.371 | 18 | 0.143 |
| Three-cycles | −0.127 | 0.208 | 0.561 | 12.104 | 16 | 0.737 | 15.880 | 16 | 0.461 |
| Known prior | −0.145 | 0.088 | 0.137 | 9.842 | 18 | 0.937 | 20.737 | 18 | 0.293 |
| Gender alter | 0.133 | 0.137 | 0.362 | 30.480 | 18 | 0.033 | 18.682 | 18 | 0.412 |
| Gender ego | −0.125 | 0.182 | 0.512 | 16.291 | 16 | 0.433 | 26.043 | 16 | 0.053 |
| Gender same | −0.482 | 0.139 | 0.008 | 4.179 | 18 | 1.000 | 76.945 | 18 | <.001 |
| Migration background same | −0.028 | 0.128 | 0.835 | 20.792 | 19 | 0.290 | 21.900 | 18 | 0.236 |
| Migration background alter | 0.057 | 0.081 | 0.499 | 23.088 | 18 | 0.187 | 9.696 | 18 | 0.941 |
| Migration background ego | −0.042 | 0.153 | 0.790 | 15.872 | 18 | 0.601 | 23.136 | 18 | 0.185 |
| Indegree popularity | 0.080 | 0.034 | 0.047 | 41.512 | 18 | 0.001 | 6.451 | 18 | 0.994 |
| Outdegree popularity | −.031 | 0.021 | 0.185 | 10.286 | 18 | 0.922 | 21.678 | 18 | 0.247 |
| Outdegree activity | 0.097 | 0.013 | 0.001 | 110.009 | 18 | <.001 | 1.214 | 18 | 1.000 |

**Table 6**

Antipathy. Results from the two meta-analyses: iterative weighted least squares method (IWLS) and Fisher's tests.

| | IWLS | | | Fisher's positive test | | | Fisher's negative test | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Mean coefficient* | *s.e.* | *p* (2-sided) | $X^2$ | d.f. | *p* (1-sided) | $X^2$ | d.f. | *p* (1-sided) |
| Density | −3.819 | 0.345 | 0.001 | 1.450 | 18 | 1.000 | 121.616 | 18 | <.001 |
| Reciprocity | 0.953 | 0.193 | 0.001 | 39.793 | 18 | 0.002 | 4.792 | 18 | 0.999 |
| Transitivity | −1.196 | 1.317 | 0.394 | 10.081 | 16 | 0.862 | 29.585 | 16 | 0.020 |
| Three-cycles | 0.089 | 0.273 | 0.755 | 11.816 | 16 | 0.757 | 16.044 | 16 | 0.450 |
| Known prior | 0.371 | 0.127 | 0.019 | 24.846 | 18 | 0.129 | 8.769 | 18 | 0.965 |
| Gender alter | 0.110 | 0.321 | 0.742 | 22.595 | 18 | 0.207 | 19.558 | 18 | 0.358 |
| Gender ego | −0.055 | 0.194 | 0.785 | 15.037 | 16 | 0.522 | 16.290 | 16 | 0.433 |
| Gender same | −0.195 | 0.290 | 0.519 | 18.354 | 18 | 0.433 | 31.287 | 18 | 0.027 |
| Migration background same | 0.128 | 0.181 | 0.499 | 26.937 | 18 | 0.080 | 10.875 | 18 | 0.900 |
| Migration background alter | −0.055 | 0.355 | 0.881 | 27.173 | 18 | 0.184 | 19.281 | 18 | 0.375 |
| Migration background ego | −0.159 | 0.242 | 0.539 | 8.107 | 12 | 0.777 | 15.347 | 12 | 0.223 |
| Indegree popularity | 0.217 | 0.035 | 0.001 | 53.615 | 16 | <.001 | 3.906 | 16 | 0.999 |
| Outdegree popularity | 0.037 | 0.032 | 0.278 | 14.965 | 18 | 0.664 | 15.669 | 18 | 0.616 |
| Outdegree activity | 0.234 | 0.032 | 0.001 | 78.685 | 18 | <.001 | 2.709 | 18 | 1.000 |

**Table 7**

Aggression. Results from the two meta-analyses: iterative weighted least squares method (IWLS) and Fisher's tests.

| | IWLS | | | Fisher's positive test | | | Fisher's negative test | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Mean coefficient* | *s.e.* | *p* (2-sided) | $X^2$ | d.f. | *p* (1-sided) | $X^2$ | d.f. | *p* (1-sided) |
| Density | −3.576 | 0.276 | <.001 | 0.628 | 18 | 1.000 | 171.242 | 18 | <.001 |
| Reciprocity | 1.341 | 0.249 | 0.001 | 50.364 | 16 | <.001 | 2.823 | 16 | 1.000 |
| Transitivity | −0.108 | 0.798 | 0.898 | 13.847 | 12 | 0.311 | 13.467 | 12 | 0.336 |
| Three-cycles | −0.295 | 0.263 | 0.305 | 7.684 | 14 | 0.905 | 18.284 | 14 | 0.194 |
| Known prior | 0.629 | 0.135 | 0.002 | 49.412 | 18 | <.001 | 2.672 | 18 | 1.000 |
| Gender alter | 0.246 | 0.303 | 0.444 | 31.074 | 16 | 0.013 | 12.358 | 16 | 0.719 |
| Gender ego | −0.201 | 0.313 | 0.539 | 14.481 | 18 | 0.697 | 23.933 | 18 | 0.157 |
| Gender same | 0.457 | 0.135 | 0.009 | 36.736 | 18 | 0.002 | 4.687 | 18 | 0.999 |
| Migration background same | −0.014 | 0.125 | 0.912 | 19.064 | 18 | 0.388 | 13.675 | 18 | 0.750 |
| Migration background alter | 0.239 | 0.119 | 0.080 | 25.940 | 18 | 0.101 | 8.088 | 18 | 0.977 |
| Migration background ego | −0.281 | 0.170 | 0.142 | 9.711 | 16 | 0.881 | 20.149 | 16 | 0.214 |
| Indegree popularity | 0.217 | 0.039 | <.001 | 56.049 | 18 | <.001 | 8.784 | 18 | 0.965 |
| Outdegree popularity | −0.004 | 0.028 | 0.894 | 10.173 | 16 | 0.857 | 15.263 | 16 | 0.505 |
| Outdegree activity | 0.149 | 0.037 | 0.004 | 70.802 | 18 | <.001 | 7.065 | 18 | 0.990 |

Hypothesis 4 was therefore not supported, as avoidance, antipathy and aggression were not more likely between a native and a non-native pupil than between two native pupils and two non-native pupils. We also did not find convincing evidence for a dyadic effect of migration background when differentiating between natives, western non-natives, and non-western non-natives (see Table A3, A4, and A5 in the online supplementary material). While homophily, or the tendency to like people who are similar, is often empirically supported, we did not find evidence for ethnic heteromisos, or the tendency to dislike people who are dissimilar in ethnicity.

*Control variables*

With regards to the control variables, it is worth noting that pupils who knew each other before becoming classmates in their new high school were more likely to dislike each other and they were more likely to be aggressive towards one another. Whether pupils knew each other from before had no effect on whether they avoided each other.

Furthermore, pupils with the same gender were generally less likely to avoid and dislike one another than pupils with a different gender. This can be interpreted as in line with the tendency for homophily, where

boys prefer to interact with other boys and girls prefer to interact with other girls. Similarly, these results are congruent with research in developmental psychology that suggests that early adolescents avoid their opposite sex peers at first but later on start seeking them out for romantic purposes (Dunphy, 1963). In contrast, the same did not hold true for aggressive behaviour, as this was more likely to occur between pupils of the same gender. This is in line with previous research on aggression in early adolescence (Faris, 2012). On average there were no alter or ego effects of gender on any of the negative networks. That said, the Fisher's tests suggested that at least in some classes boys were more likely to be victimized and avoided than girls.

Finally, some of the network effects that we included as control variables significantly explained the formation of negative networks. While three-cycles (gwespBB) and outdegree popularity (outPop) did not affect avoidance, antipathy or aggression, we did find positive effects of indegree popularity (inPop) and outdegree activity (outAct) for all three negative networks. These additional results suggest that pupils who were negative towards some of their classmates at the beginning of the schoolyear were more likely to be negative towards more classmates further on in the year. At the same time, pupils behaved negatively towards classmates who were already treated negatively by others.

## Discussion

We set out to explain the existence of negative relationships amongst first year pupils in high schools in the Netherlands, and sought to make two overarching contributions to the academic literature on negative networks.

First, we tested whether status theory can explain all negative relationships equally well, or whether appreciating differences between different types of negative ties can help explain inconsistent results of previous research. We argued that status hierarchies can be operationalized in terms of reciprocity and transitivity; and that avoidance, antipathy, and aggression can be distinguished from one another based on cost and visibility.

In contrast to our expectations, all three negative networks were not found to be transitive in a way that matches an archetypical status hierarchy. If pupil A dominated pupil B, and pupil B dominated pupil C, then pupil A was not more likely to dominate pupil C as well. We hypothesized that pupils who are treated negatively, and are thereby deprived of status, possibly treat other pupils negatively in order to feel powerful themselves. Or, in the words of Allport (1954, p. 153): "Pecked at by those higher in the pecking order, one may, like a fowl in the barnyard, peck at those seen as weaker and lower than oneself." Our data do not support such a archetypical status hierarchy, made up of triads in negative networks. Further, because we did not find an effect of transitivity on the negative networks, we also could not test our expectation that the more visible types of negative behaviour were more transitive, with aggression being most transitive and antipathy being least transitive.

However, we did find positive effects of both indegree popularity and outdegree activity on all three negative networks. These results suggest that pupils who were negative towards some of their classmates at the beginning of the schoolyear were more likely to be negative towards more classmates further on in the year, and that pupils behaved negatively towards classmates who were already treated negatively by others. When we tentatively interpret these additional findings in light of status struggles, some pupils were negative towards an increasing number of classmates and could therefore be seen as occupying a high position in the status pyramid. At the same time, there were also some pupils who were treated negatively by an increasing number of peers and who could thus be seen as occupying a low-status position in the pyramid. In any case, there appears to be some consensus amongst pupils about which classmates to avoid, dislike, and victimize.

Furthermore, the avoidance and antipathy networks were more dense than the aggression network (see Table 4). This ranking is in line

with the assumption that costly behaviour is less common. However, not only did we expect reciprocity to have a negative effect on negative behaviour, we also expected reciprocity to have a stronger negative effect on more costly forms of behaviour. Both expectations were contradicted by our findings.

A negative effect of reciprocity was expected based on the idea that an archetypical social hierarchy is asymmetrical: if pupil A is superior to pupil B, B cannot also be superior to pupil A. Yet pupils do reciprocate negative behaviour, as is suggested by our results, but also by other recent studies (Berger and Dijkstra, 2013; Boda and Néray, 2015). Perhaps rather than allowing themselves to be dominated by their classmates, pupils fight back and reciprocate. This is at least suggested by anecdotal evidence from a more qualitative study on antipathetic relationships in high schools from Card (2007, p.45): "If she won't like me, I'm going to not like her back".

The other surprising finding is that costly behaviour is *more* likely to be reciprocated. This also seems to be supported by the results from another recent study on violence and dislike networks, where the positive effect of reciprocity appeared to be stronger for violence than for dislike (Wittek et al., 2019). These findings could suggest that not reciprocating costly behaviour might also be more costly to one's own status position. Being victimized without fighting back might be worse in terms of losing face than being avoided without avoiding in return. Future research could thus consider whether certain types of negative behaviour are more effective ways to gain status, and also more detrimental to pupils' social position if they find themselves at the receiving end of this negative behaviour.

More broadly speaking, the consistent positive effects of reciprocity combined with the absence of transitivity in our negative networks require us to reconsider what status hierarchies should look like. The simple idea of a transitive and asymmetrical pecking order is not supported by our data. There appears to be some consensus on which pupils are on the lower side of the social order, but these pupils don't just accept their position without questioning or fighting back. The pecking order is not set in stone. There are still status struggles. Previous research suggests that status, including the hunger to climb and the fear to fall down the social ladder, is particularly important and volatile during adolescence (Coleman, 1961; Faris, 2012; Savin-Williams, 1979). This also confirms the usefulness of our dynamic and longitudinal approach to studying negative relationships amongst high school pupils.

In addition, unsettled status struggles might be particularly common amongst pupils who feel the need to resort to negative behaviour for social climbing. Previous research suggest that pupils who already find themselves at the top of the social ranking do not use aggression as a means to achieve status (Faris and Felmlee, 2011). For them, being nice to others is a better way to consolidate their position. Perhaps our singular focus on negative behaviour has put emphasis on those pupils who are not the most popular, and are still struggling to gain or maintain their status position.

Our second contribution to the literature on negative networks was to have a closer look at the role of the migration background of pupils. We have done so in two ways. First, we tested whether migration background can be seen as an indicator of low status, explaining why non-native pupils might be avoided, disliked, and victimized more than their native classmates. We did not find any evidence for this notion. Second, we tested whether negative relationships in high school classes are governed by heteromisos, and are thus more likely to be interethnic than intraethnic. This was not supported by our data either. While homophily – or the like for similar people – is an often found aspect of friendships, it does not seem to translate into a dislike for dissimilar people. Attraction to similar people seems to be more important than repulsion of dissimilar people in governing who interacts with whom (Chen and Kenrick, 2002). Moreover, even though the ethic group to which someone belongs may form a source of pride and self-esteem (Tajfel and Turner, 1979), this does not necessarily translate into the need to devalue other ethnic groups or resort to negative behaviour

directed at pupils with a different ethnic background. Further distinguishing between non-native pupils with a western and a non-western backgrounds did not matter for our conclusions on the influence of migration background.

There are some limitations to our study that should be mentioned. First of all, our data consisted of a fairly small number of classes and schools. This warrants some caution in generalizing our findings to all secondary school pupils in the Netherlands, or even abroad. The small number of classes could also offer an explanation as to why some of the differences between the three negative networks in terms of the effects of reciprocity were not found to be significant. In addition, it is important to note that the comparison of effect sizes across models has to be done with some caution. This is because the estimates are affected by contextual factors such as the size of the networks.

Second, our data did not include an alternative measure of status. Previous research has also operationalized status in terms of an attribute, such as winning a yearbook award (Faris, 2012), or looked at status as perceived by the pupils themselves (Lease et al., 2002). Such measures could have been used to validate our operationalization of an informal hierarchy in terms of reciprocity and transitivity. Futures studies could also measure status as an attribute to follow up on the suggestion that more extreme or costly behaviour, like aggression, may be more effective at attaining status than more benign negative behaviour, like avoidance. That said, we still think that a sociometric approach to status has its merits. Status hierarchies inferred from dyadic behaviour have been found to be largely similar to the self-reported or perceived hierarchies (Savin-Williams, 1979).

Third, we did not account for the influence of positive ties, such as friendships. This omission could be important in two ways. For one, having many friends and being liked by many classmates is another way to attain status and climb the social ladder (Faris, 2012). Further, friendships could also explain negative behaviour amongst pupils. For example, adolescents tend to dislike whoever their friends dislike (Pál et al., 2016). Furthermore, by not including friendship networks in our analyses, we have not taken into account the possibility that negative behaviour may also occur between friends. It could even be argued that some negative behaviour, aggression in particular, requires the kind of intimacy of a friendship. The potential overlap between negative behaviour and friendship could therefore be an alternative mechanism behind the positive effects of reciprocity in our negative networks. We believe this to be particularly relevant for aggression. In the case of avoidance and antipathy, however, it is less immediately evident why they would coincide with friendship. They seem to be almost mutually exclusive. Why would one avoid or dislike ones friends? Yet like aggression, dislike and avoidance are also reciprocal. So there appears to be something else about negative networks, irrespective of the potential overlap with friendship ties, that makes them reciprocal.

Relatedly, the omission of friendship networks might also have had its bearing on our results regarding the effect of migration background on aggression. If we assume that aggression may also coincide with friendship, and we take into consideration that friends are more likely to be co-ethnics, then aggression could also be expected to occur between co-ethnics. Indeed, Wittek et al. (2019) found that violence tends to happen within ethnic groups. This mechanism could have acted as a countervailing force to heteromisos, which could offer an alternative reason why we did not find an effect of migration background on aggression. Antipathy and avoidance, on the other hand, likely occur with pupils who are not friends, and could therefore be expected to be less likely between classmates of the same ethnic background.

Overall, our contributions to a better understanding of the qualitatively different nature of the different types of negative networks, like antipathy and aggression, could be used to form more specific hypotheses about the interplay between particular positive networks and particular negative networks. We believe these are very interesting avenues for future research.

Furthermore, we have also performed additional analyses in order to explore the extent to which the avoidance, antipathy, and aggression networks co-evolve (see Tables A10, A11, and A12 in the online supplementary material). We find no evidence for this possibility. For one, our results do not support the notion that if pupil A behaves negatively towards pupil B, by for example by being aggressive, pupil A will subsequently dislike or avoid pupil B as well. Similarly, we do not find that one negative network is reciprocated in the other. For instance, if pupil A is aggressive towards pupil B, pupil B does not in turn appear to be more likely to avoid pupil A.

A fourth and final limitation of our study is the rather limited measure of migration background, which was based on the rather crude distinction between native pupils, pupils with a western migration background, and pupils with a non-western migration background. Although this classification is commonly used in research in the Netherlands (Geerlings et al., 2018), and by Statistics Netherlands, it might not align perfectly with how ethnicity is experienced by the pupils themselves. However, our null findings are congruent with other recent research on interethnic bullying in the Netherlands that used a slightly more detailed measure of ethnic background (Tolsma et al., 2013). That said, the way in which we operationalized migration background could offer another explanation as to why we do not find evidence for an effect of migration background on negative networks, as other recent studies do (Wittek et al., 2019). Future research could include self-report measures of ethnicity and analyse a bigger sample of adolescents. The latter would enable researchers to make more fine-grained distinctions based on ethnicity, as it reduces the chance at empty or severely underrepresented categories.

Notwithstanding the importance of these limitations, the current paper makes some crucial contributions to the burgeoning literature on negative networks. Using three waves of network data collected in Dutch high schools, we have shown that not all types of negative behaviour are the same. By employing novel methods of dimension reduction in networks (Vörös and Snijders, 2017), we studied three distinct types of negative behaviour: avoidance, antipathy, and aggression. These types of ties have been argued to differ from one another in terms of their cost and visibility. The migration background of the pupils did not explain negative relationships between classmates. Further, our results require us to reconsider what status hierarchies should look like. The simple idea of a transitive and asymmetrical pecking order is not supported by our data. Instead, we found that negative behaviour was governed by reciprocity, and that there are pupils that behave negatively towards a lot of their classmates, and that there are pupils that are treated negatively by many classmates. There appears to be consensus amongst the adolescents on who to avoid, dislike, and be aggressive towards. However, these pupils do not just settle for an inferior position in the social hierarchy. They fight back and struggle for their status position.

## Funding

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.socnet.2020.08.006.

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